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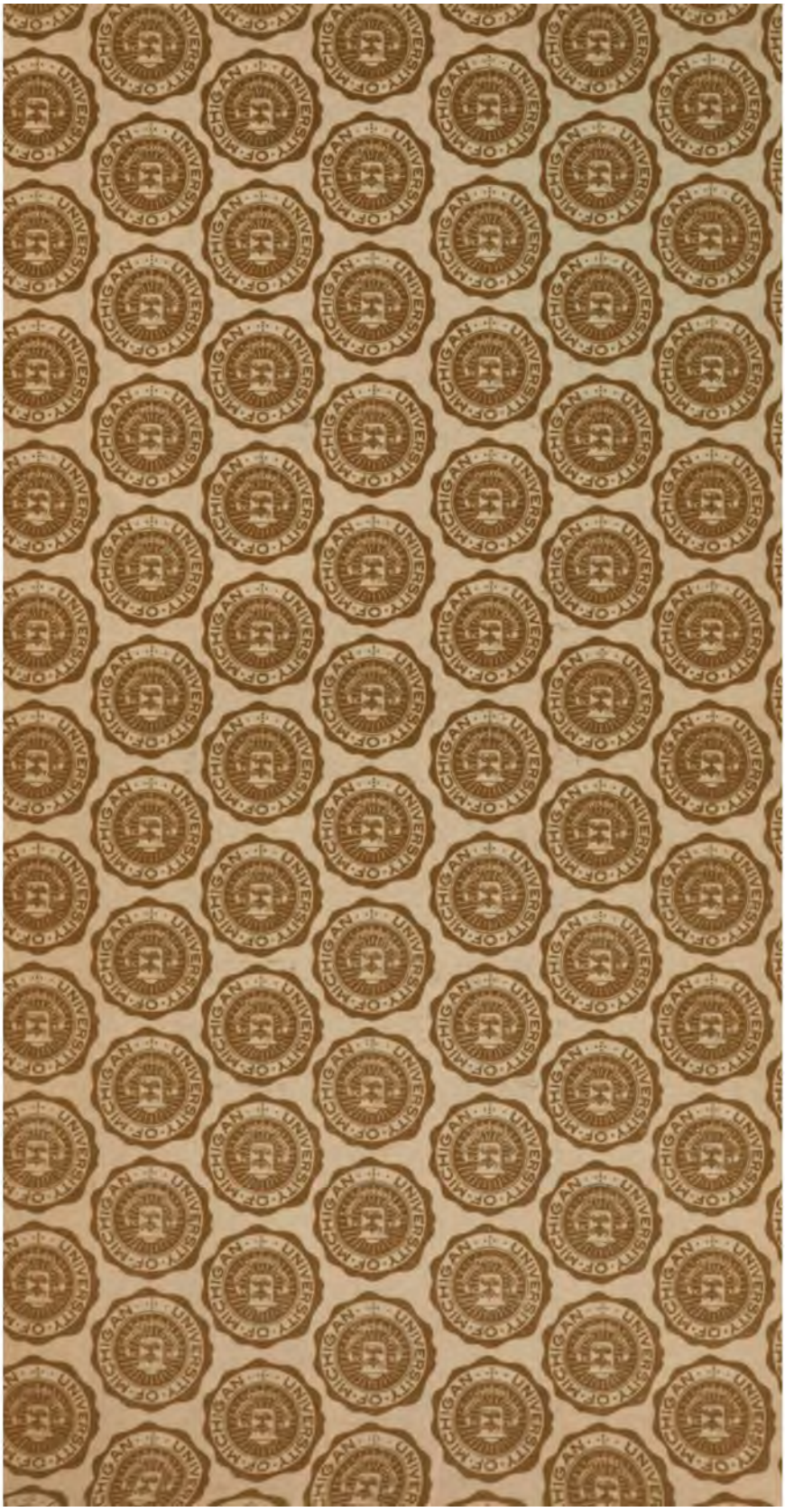

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UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 102 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

THE FERROALLOY INDUSTRIES

Paragraph 102:
- Ferrosilicon
- Ferrochrome
- Ferrotungsten
- Ferrovanadium
- Ferromolybdenum
- Ferrotitanium
- Ferrophosphorus
- Minor Ferroalloys

Paragraph 518:
- Iron-Manganese Alloys
  - Ferromanganese
  - Spiegeleisen

REVISED EDITION

WASHINGTON
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UNITED STATES TARIFF COMMISSION.

Office: Eighth and E Streets NW., Washington, D. C.

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PREFACE.

The following report takes the place of a series of Tariff Information Surveys covering the manufacture of all the important ferroalloys and originally prepared from available sources of information for use of the United States Tariff Commission. The pioneer character of some branches of ferroalloy manufacture made desirable an intensive investigation of this field of production, both in the United States and abroad. The similarity in use and character of the several ferroalloys, notwithstanding a greatly varying tariff problem in each case, has led to the embodiment of the results in a single report. This report, prepared by the United States Tariff Commission, was transmitted to the Committee on Ways and Means. In its present form the report is a revision of the one printed for the use of the House committee mentioned, with certain trade and price statistics brought up to date.

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PREFACE.

This report is a study of the ferroalloy industries whose development in the United States is very recent and upon which some of our leading branches of manufacture are largely dependent. The growth of the steel industry during the last half century is intimately associated with the use of spiegeleisen and ferromanganese. Specialized uses of steel emphasized the need for varying qualities in the metal employed, and this need has called into existence industries capable of satisfying the demand. To-day certain ferroalloys which were either unknown or in an experimental stage a few decades ago are now recognized not only as commercial necessities but as military and political essentials.

From a tariff standpoint the manufacture of the ferroalloys illustrates many points of interest. Some ferroalloys are made by processes whose operation is cheaper in this country than abroad; others are produced under conditions which make their manufacture here more expensive. Some ferroalloys are made entirely of domestic raw material; others are dependent upon the imported product. The effect of these conditions upon the competitive position of American manufacturers is worthy of study.

There is, furthermore, in any proposal of tariff legislation the problem of a proper correlation of duties in different stages of manufacture. The fixing of compensatory duties, for example, depends upon a proper recognition of the losses of material involved in passing from one stage of production to another. These losses are by no means uniform, but vary with the ores used and process of manufacture employed.

The study of the ferroalloy industries in the light of their conditions of manufacture reveals the need, which is strongly felt in other lines of production, for a better and more up-to-date classification of products in the tariff schedules. This need is urgent, irrespective of the tariff policy followed.

In the preparation of this report the commission had the services of Abraham Berglund, of the metals division of the commission's staff, and of others.

SUMMARY.

THE FERROALLOYS.

The ferroalloys are special products consisting of iron and some other chemical element (usually a metal) whose use in the manufacture of steel serves to give the latter more desirable qualities. In addition to the two principal constituents, there is a small percentage of other ingredients, of which carbon is generally the most important.

The ferroalloys perform one or both of two functions—they are purifying or deoxidizing agencies in steel manufacture, and they add to steel elements which give it certain necessary or desirable qualities. In the performance of these functions the ferroalloys have made possible in recent times the great development of the steel industry, the automobile industry, the manufacture of high-speed tools, and the production of much of our electrical appliances.

The element or metal combined with iron in the ferroalloy is usually the more valuable one in the combination, and its amount is generally the principal determinant of the price of the alloy. In some cases this element or metal is used by itself without first being alloyed with iron. In the manufacture of high-speed tools, for example, in which tungsten is an important ingredient, either tungsten metal or ferrotungsten may be employed in adding tungsten to the steel.

The most important of the ferroalloys, or alloying metals, are the iron-manganese alloys (spiegeleisen and ferromanganese), ferrosilicon, ferrochrome, tungsten metal and ferrotungsten, ferrovanadium, molybdenum and ferromolybdenum, ferrotitanium, and ferrophosphorus. Besides these are various minor ferro alloys which are used in limited amounts and largely in experimental ways.

THE IRON-MANGANESE ALLOYS.

Description.—The iron-manganese alloys consist of spiegeleisen and ferromanganese. When these alloys have less than 45 per cent manganese, they are called spiegeleisen, and when they have 45 per cent or more they are called ferromanganese. Standard spiegeleisen has a manganese content of about 20 per cent, and standard ferromanganese 76 to 80 per cent.

Uses.—Both spiegeleisen and ferromanganese are employed to purify and add manganese to steel. The former is used where high-carbon or hard steel is manufactured, and the latter where low-carbon or soft steel is produced.

Production.—In the year 1919 the output of spiegeleisen in the United States amounted to 84,246 gross tons, and that of ferromanganese to 185,357 gross tons. In 1918 the production was greater, that of spiegeleisen amounting to 283,853 gross tons, and that of ferromanganese to 333,027 gross tons.

Method of production.—All the spiegeleisen and most of the ferromanganese produced in the United States are made in blast furnaces. A small amount of ferromanganese is manufactured in electric furnaces, but at greater expense than the blast-furnace product. In blast-furnace production the coke consumption is greater than in the case of pig iron, which is often produced alternately in the same furnace with the iron-manganese alloys.

Raw materials.—Ores containing manganese, stone (limestone or dolomite), coke, and iron (iron ore, pig iron, or scrap) constitute the raw material. The first is by far the most valuable, and constitutes a large part of the total cost of producing this alloy. The stone, coke, and iron are of domestic production. The manganese ores employed in the manufacture of spiegeleisen are also produced in this country. Manganese ores used in the manufacture of ferromanganese, however, are for the most part imported from India and Brazil, as the native ores are either too costly or contain too much silica and too little manganese, thus increasing the metallic losses and augmenting the expense of manufacture.

Prices.—The prices of spiegeleisen and ferromanganese are both quoted by the gross ton and on the basis of the manganese content for the standard grade of each. The average Pittsburgh selling price of spiegeleisen with a manganese content of 16 to 20 per cent in 1919 was $45.78 per gross ton, and during the first six months of 1920 $58.85. In 1913 the average price was $25.51.

The price of ferromanganese varied greatly during the war. The annual average quotation for 1913 was $57.87 per gross ton; for 1917, $309.17; for 1919, $137.24; and for the first six months of 1920, $188.46. In December, 1920, standard ferromanganese was quoted at $110 per gross ton.

British prices of ferromanganese ranged lower than American. Thus in 1919, while the American price was $137.24 for the standard grade, the English price was $102.36.

Foreign production.—The iron-manganese alloys are produced in England and Germany in large amounts, and in other countries in smaller quantities. The greater part of these alloys made in England consists of ferromanganese, which is largely exported. The English output of ferromanganese in 1918 amounted to 246,943 gross tons. Germany produces much spiegeleisen, but its ferromanganese is inferior to the British and American product.

Imports.—Very little spiegeleisen is imported. In the calendar year 1919 the importation amounted to only 27 gross tons. The importation of ferromanganese is much larger, amounting in 1919 to 33,022 gross tons. Just before the outbreak of the World War, about half the ferromanganese consumed in the United States was imported. The bulk of this material has come from England.

Exports.—The exports of spiegeleisen are negligible and those of ferromanganese small. The exports of the latter amounted to 2,999 gross tons in 1919, or less than one-tenth of the imports.

Tariff considerations.—These may be embraced under four general heads: (1) Classification; (2) competitive conditions; (3) compensatory duties; and (4) revenue possibilities.

(1) Spiegeleisen and ferromanganese have been classified in our ariff laws for several decades with "iron in pigs." While they are blast-furnace products, their uses and conditions of production vary

greatly from those of pig iron. They belong to the general class of ferroalloys.

(2) No question now arises with reference to the competitive position of the American producer of spiegeleisen. His raw material is abundant and cheap and his conversion costs are low. In the case of ferromanganese, however, the American manufacturer is obliged to get his raw material abroad. Ocean freights from India to England are quoted at less than to the Atlantic seaboard of the United States. They are less from Brazil to the United States than from India, but the higher cost of mining ores in Brazil and bringing them to the coast, plus provincial export taxes, keep the prices of manganese ores relatively high in this country. The demoralized monetary conditions prevailing in the world are also handicaps to the American producer.

According to figures secured by the Tariff Commission on the cost of production, about 70 per cent of the total expense of manufacturing ferromanganese is the price paid for the manganese in the ore. Hence ore cost is important in determining the competitive position of the American manufacturer.

With reference to conversion cost, the American producer is at no disadvantage compared with his English competitor. Coke is cheaper in the United States than in England, and the higher wage rates prevailing here are offset in a measure by larger furnaces and greater output per man employed.

(3) As manganese ores and ferromanganese and spiegeleisen are on the free list, no question now arises in regard to compensatory duties. Should, however, duties be levied either on the ores or on the alloys, the question of compensatory duties would arise. In passing from one stage of manufacture to another, there is always some loss involved, and this loss should be allowed for in imposing compensatory duties. In the manufacture of ferromanganese, the recovery of metal contained in the ore averages in good practice about 80 per cent. The recovery of metal in the manufacture of manganese steel (12 to 15 per cent manganese) is about 80 per cent in electric furnaces and about 70 to 75 per cent in open-hearth furnaces.

(4) In the fiscal year 1913, when the duty on ferromanganese was $2.50 per ton and the importation was 128,136 tons, the revenue derived by the Government was $320,341. A similar duty on the much smaller importation of 1919 would have yielded $82,555.

FERROSILICON.

Description.—Ferrosilicon is an alloy of iron and silicon, and ranges in silicon content from 7 or 8 per cent to over 90 per cent. When the silicon content does not exceed 15 per cent, it is known as Bessemer ferrosilicon. The standard grades are those with 12 and 50 per cent silicon content.

Uses.—Ferrosilicon is used in the manufacture of iron and steel to remove dissolved oxygen and to increase the silicon content of steel. The first function is the principal one, but the second is of growing importance. High-grade castings, electric transformers, and shell steel require the use of ferrosilicon in their manufacture.

Production.—The output of ferrosilicon in the United States in 1919 amounted to 181,751 gross tons. In 1918, the country's production was 297,940 gross tons.

Method of production.—Ferrosilicon of the grades containing a silicon content in excess of 15 per cent is manufactured in electric furnaces. The grades containing 15 per cent silicon or less are made, for the most part, in blast furnaces. The electric furnace is being used, however, to a greater extent than formerly in the production of the lower grades of this alloy.

Raw material.—The raw materials consist of silicon rock (sandstone) or quartz, iron ore or scrap-steel, and coal or coke. The last is used as fuel where the blast-furnace process prevails and as a reducing agent where the electric-furnace method obtains.

Foreign production.—Ferrosilicon is produced in Canada, Norway, Sweden, France, Germany, and Austria. Most of these countries use the electric-furnace method. In England, blast-furnace ferrosilicon is manufactured to a limited extent.

Imports.—Practically all the imported ferrosilicon comes from Canada, but before the war a considerable amount was imported from Sweden and Norway. Nearly all the imported ferrosilicon is the electric furnace product. Imports in the calendar year 1919 amounted to 10,445 tons.

Exports.—Very little ferrosilicon is exported. In 1919 exports amounted to 1,544 tons, most of it low grade.

Prices.—The price of ferrosilicon depends upon the silicon content. During the first six months of 1920, the price of 12 per cent ferrosilicon averaged $57.91 per ton and that of the 50 per cent product $87.34 per ton. In the years 1912 to 1914, inclusive, the corresponding averages were $23.13 and $73.25, respectively. The reason for the relatively low price of the 50 per cent grade in 1920 is the intense domestic and foreign (Canadian) competition following the close of the war.

Tariff considerations.—There is a broad distinction between the grades containing 15 per cent silicon or less and those containing more. The former are for the most part made in blast furnaces and are as cheaply manufactured in the United States as in any part of the world. In the manufacture of the higher grades, which are produced in electric furnaces, the cost of electric power constitutes a large item in the total expense. It is for this reason that manufacturers of the higher grades of ferrosilicon in this country move to Niagara Falls and other places where the price of power is cheap.

Hydroelectric power is cheaper in some countries than in the United States. This is owing to the fact that in these countries there is a better combination of high heads and steady flow of water than generally exists in this country. While manufacturers at Niagara Falls, N. Y., pay $20 per horsepower year, in Canada they pay from 25 to 40 per cent less. In Norway the price of power has been even lower than in Canada.

Another fact having a tariff bearing is the large production of ferrosilicon in countries having a small consumption. In such cases, where an ad valorem rate is imposed, it may be good business policy

for manufacturers to sell the small amount consumed at home at comparatively low prices in order to establish a low basis for exports on which to compute the ad valorem rate.

FERROCHROME.

Description.—Ferrochrome is an alloy of iron and chromium. It is graded per unit of chromium and per cent of carbon, the value increasing with the former and tending to diminish with the latter. Ferrochrome is sold on the basis of contained chromium 60 per cent or more.

Ferrochrome may be divided into the high-carbon grades, containing 4 to 8 per cent carbon, and the low-carbon grades, containing 2 per cent carbon or less. Included with the latter group is the alloy called carbon-free, in which the carbon is only a very small fraction of 1 per cent.

Uses.—Ferrochrome is used extensively in the manufacture of steel for armor plate, armor-piercing projectiles, wire, bullet-proof steel, tool steel, and the like, where hardness and toughness are desirable qualities. It is employed only as an alloy.

Production.—The country's output of ferrochrome is not so large as that of ferromanganese, spiegeleisen, or ferrosilicon. Measured in tonnage, however, it is the most important of the ferroalloys sold by the pound. During the years 1915 to 1919 the annual production varied from 9,000 to 25,000 gross tons.

Foreign production.—France, Norway, Germany, and Switzerland are important producers of ferrochrome. England, which manufactured very little prior to the war, now largely supplies her own market.

Raw material and method of production.—Ferrochrome is made in electric furnaces. The raw material used in production consists of chromite and coal, coke, or charcoal. Most of the chromite is imported, the best coming from New Caledonia and Rhodesia.

Imports.—Very little ferrochrome was imported during the war, but after the signing of the armistice imports increased again. In the calendar year 1919 imports amounted to 926,616 pounds (about 414 gross tons). The imported ferrochrome came largely from France and Norway.

Exports.—Practically no ferrochrome is exported.

Prices.—The price of ferrochrome is quoted by the pound of contained chromium. As the chromium content rises, the price increases with each additional unit, assuming a fixed carbon content. Where the carbon content ranges from 4 to 8 per cent the price varies inversely to a slight extent with each per cent of increase. Where the carbon content is reduced below 2 per cent the price rises rapidly.

In June, 1920, ferrochrome containing 4 to 8 per cent carbon was quoted at 18 to 19 cents per pound of contained chromium. In December it was quoted at 16 to 17 cents per pound.

Tariff considerations.—In grading ferrochrome a distinction should be made between the high-carbon (4 per cent or more carbon) and the low-carbon grades (2 per cent or less). The latter grades are much more expensive on account of additional refining or more costly processes employed.

In the manufacture of ferrochrome the cost of chromite, the price of electric power, and labor cost constitute about 70 per cent of the total expense of manufacture, and are the most important items. The price of electric power and labor cost are greater in this country than in Norway and France, from which most of the imported ferrochrome comes. There is also evidence that the Norwegian and French manufacturers get their chromite at lower prices than the American producers.

The revenue derived from the importation of ferrochrome in 1919 amounted to $15,060.

TUNGSTEN AND FERROTUNGSTEN.

Description.—Tungsten and ferrotungsten, like ferrochrome, is used in making alloy steels. Tungsten is added to the steel either in the form of metallic powder or in that of a ferroalloy. Tungsten alloys with iron in all proportions, but commercial ferrotungsten has a tungsten content ranging from 70 to 85 per cent.

Uses.—The greatest use of tungsten metal and ferrotungsten is in the manufacture of tool steels, especially "high-speed" steels. Other uses are the manufacture of self-hardening steels, permanent magnets, electric lamp filaments, and automobile-engine valves.

Production.—There are no reliable published figures regarding the country's output of ferrotungsten. An incomplete record of shipments in this country in 1918 showed a production of 2,142 tons. In 1919 the output had declined but was considerably over 1,000 tons.

Raw material and method of production.—The most important raw material used in the manufacture of tungsten metal and ferrotungsten is tungsten-bearing ore. Most of this ore is imported from China, although during the war the country relied largely upon ores mined in California and Colorado. Domestic ores are generally free from such deleterious substances as tin, copper, and arsenic, but are very expensive to mine.

Tungsten metal is produced by a chemical process known as the "wet process," and ferrotungsten by the electric furnace.

Imports and exports.—Before the war the greater part of the tungsten and ferrotungsten used in this country was imported from Germany. During the war imports declined, while there was a considerable exportation. In 1919 imports increased again, while exports diminished, the former amounting to 396,460 pounds (198 short tons) and the latter to 38,130 pounds (19 short tons). Most of the imported tungsten and ferrotungsten now comes from England.

Prices.—The price of ferrotungsten is quoted by the pound of contained tungsten. The metal is also quoted by the pound and ranges somewhat higher than the metal in the alloy. During the war the price of ferrotungsten in the open market went at one time as high as $8 per pound, but generally ranged between $2 and $2.50 per pound. In 1920 the price had declined to about $1, and in December of that year it was quoted at 65 to 75 cents per pound.

Tariff considerations.—The manufacture of ferrotungsten and tungsten metal in the United States is subject to very severe foreign competition. From 70 to 80 per cent of the total cost of manufacture consists of the price of the metal in the ore. Tungsten-bearing ores have been quoted lower in England than in the United States.

The English manufacturers also have a slight advantage in lower labor cost and utilization of waste products.

If any duty is placed on tungsten-bearing ores, a compensatory rate on the ferroalloy should allow for a recovery of about 85 per cent of metal. In the manufacture of tungsten steel the recovery averages about 78 per cent.

In 1919 (calendar year) the revenue collected on imports amounted to $43,197. In 1913 it amounted to $159,093.

FERROVANADIUM.

Description.—Standard ferrovanadium contains from 30 to 40 per cent vanadium and about 60 per cent iron. Ferrovanadium is employed to add vanadium to steel, which is thereby toughened and rendered unusually resistant to shock and alternate stresses.

Raw material and method of production.—Ores containing vanadium constitute the principal raw material, and are found in Peru and Colorado. The ore supply in both regions is controlled by American interests.

Production, imports, and exports.—In 1918, when production was at its highest, the domestic output of ferrovanadium amounted to over 2,700 short tons. There were no imports that year, while exports aggregated over 1,000 tons, or more than one-third the domestic output.

In the calendar year 1919 about 5½ short tons were imported and 33 tons exported.

Prices.—Ferrovanadium is a high-priced ferroalloy, the quotations ranging in 1920 from $5.50 to $7.75 per pound of contained vanadium.

Tariff considerations.—American interests practically control the world's output of ferrovanadium and are therefore without foreign competition.

MOLYBDENUM AND FERROMOLYBDENUM.

Description.—Molybdenum is a heavy, white, tenacious metal, having an exceptionally high melting point. Ferromolybdenum is a combination of iron and molybdenum, the percentage of the latter ranging from 50 to 80. Molybdenum is added to steel to give it greater toughness and tensile strength. Steel containing 1 per cent or less molybdenum has been used by automobile manufacturers for rear-axle and crank-shaft material.

Raw material and process of production.—The raw material is molybdenite, found in scattered deposits in Australia, Norway, Sweden, and the United States. This country is now the largest producer of molybdenite. The alloy is made in electric furnaces.

Production and consumption.—Production is not large in this country, as there has been much prejudice against the use of molybdenum. This prejudice, however, is declining.

Imports and exports.—Imports for the calendar year 1919 amounted to 102,700 pounds (51 short tons). Prior to the war, annual imports ranged from 7 to 9 tons. Late in 1919 imports were declining. Some ferromolybdenum is exported, but there are no published figures.

Tariff considerations.—The United States is well supplied with deposits of molybdenite, and the cost of this raw material is the most important item in the expense of manufacture. Labor cost and the price of electric power are higher in this country than in some European countries. On the whole, however, the American manufacturer is not seriously handicapped by foreign competition.

In 1919 the revenue derived from imports amounted to $6,114.

FERROTITANIUM.

Description.—Ferrotitanium is an alloy of iron and titanium, the percentages of the latter ranging from 15 to over 25. There are two kinds of this alloy—ferrocarbon titanium, containing about 7 or 8 per cent carbon, and the carbon-free alloy, in which the carbon content is negligible.

Ferrotitanium is used solely as a scavenger or cleanser of steel. It is a powerful deoxidizer and also removes nitrogen

Raw material and methods of production.—The raw material consists of titaniferous iron ores, titanium dioxide and iron-titanium dioxide. At the present time (1920) the raw material is derived from domestic sources, but formerly much was imported.

Ferrocarbon titanium is made in electric furnaces, and the carbon-free material by the aluminum process.

Production and consumption.—Production in the United States is confined to two companies, and hence figures are withheld. Production and consumption are nearly equal.

Imports and exports.—Imports are small, amounting in 1919 to about 6 short tons. There are some exports of ferrocarbon titanium, but they are not large and are not separately published.

Prices.—Ferrocarbon titanium is sold by the net ton, and the carbon-free product by the pound of contained titanium. In 1920 the price of the former was about $200 per ton, and that of the latter 40 cents per pound of contained titanium.

Tariff considerations.—There is practically no foreign competition with respect to this alloy. The consumption of electric power in the manufacture of ferrocarbon titanium is great, and there is potential competition from countries having cheaper power costs.

FERROPHOSPHORUS.

Description.—Ferrophosphorus is a combination of iron and phosphorus. There are two grades, one containing 16 to 20 per cent phosphorus and the other 20 to 25 per cent. The principal use of ferrophosphorus is to raise the phosphorus content of sheet bars from the open-hearth limit of about 0.025 per cent to the Bessemer limit of about 0.10. This is done in order to diminish the loss involved in stripping or tearing apart plates or sheets.

Process of production.—The raw material of this ferroalloy is apatite, or other phosphorus-bearing mineral, and scrap iron or steel. Most of the ferrophosphorus made in the United States is produced in blast furnaces, but some is manufactured in electric furnaces.

Production and consumption.—During the years 1912 to 1919, inclusive, the average annual output of the United States exceeded 7,000 gross tons. The amount consumed is approximately equal to that produced.

Imports and exports.—Exports are small and are not separately published. Imports in 1919 amounted to 76 gross tons.

Prices.—In 1919 ferrophosphorus was selling at $125 per ton at furnace.

Tariff considerations.—There is no serious foreign competition with respect to the sale of ferrophosphorus in this country. Unless the cost of electric-furnace manufacture is reduced abroad so that the electric-furnace product can compete with the blast-furnace alloy here, the American producer is secure in the domestic market.

MINOR FERROALLOYS

Other ferroalloys are produced in very limited amounts and, for the most part, are in an experimental stage. Among these alloys are ferrouranium, ferroboron, ferroaluminum, ferrozirconium, and ferrocerium.

GENERAL TARIFF SITUATION.

The general tariff situation with reference to competitive conditions and revenue possibilities may be graphically illustrated as follows:

Alloys.	Degree of foreign competition.	Disadvantages of American producers.	Revenue possibilities.
Iron-manganese alloys:			
Spiegeleisen	Negligible	None	Very little.
Ferromanganese	Great	High cost [1] of manganese ores	Considerable.
Ferrosilicon:			
Blast-furnace ferrosilicon (8 to 15 per cent silicon).	Negligible [2]	None	Little.
Electric-furnace ferrosilicon (16 per cent and above).	Great	High cost of electric power; to less extent high cost of scrap steel.	Considerable.
Ferrochrome	do	High cost [1] of chromite and electric power.	Do.
Tungsten and ferrotungsten	Severe	High cost [1] of tungsten-bearing ores.	Do.
Ferrovanadium	None	None	Negligible.
Ferromolybdenum	Negligible	do	Little.
Ferrotitanium	do	None; potential disadvantage in matter of electric power cost.	Do.
Ferrophosphorus	do	None; potential disadvantage in power cost being reduced below blast-furnace cost.	Limited.

[1] The high cost referred to in case of ores is *relative* high cost, i. e., greater cost to American than to foreign producers. Some ores, like tungsten-bearing ores, are low compared with the past.

[2] Recently there has been considerable importation of low-grade ferrosilicon. Most of this product has been made in electric furnaces.

THE FERROALLOY INDUSTRIES.

INTRODUCTION.

The ferroalloy industries, studied in their international aspects, illustrate some of the most salient features of the tariff problem. These industries are devoted to the production of a class of commodities having certain common or similar uses. Notwithstanding this common character and general similarity in the technique of manufacture, the economic conditions of production vary greatly with the article manufactured. As a result the tariff problem is not the same for all the ferroalloys. In fact, it varies in some instances with the grade of alloy produced.

The ferroalloy industries, while not among the largest of our manufacturing industries measured by the amount of capital invested, number of men employed, or quantity and value of output, are of supreme importance to some of these leading branches of production. Iron and steel manufacture on its present large scale depends upon the use of certain ferroalloys. The efficiency of the automobile, machine tools, and some electrical appliances is due in large measure to the addition of certain metals to the steel of which these articles are composed, this addition being made possible by the products of the industries which are the subject of this report. The World War, too, brought into prominence the significance of the ferroalloys from a military standpoint. The kind of steel used for armor plate, projectiles, shrapnel, and tools employed in the manufacture of ordnance material was of utmost importance in deciding the eventual outcome of this great struggle.

Coupled with the importance of the ferroalloy industries is their comparatively recent development. New industries are generally subject to much experimentation and characterized more or less by a changing technique. The possibilities of the future always make the competitive situation of such industries much more uncertain than the position of those which have had a long-established existence.

The tariff laws of both this country and foreign countries have treated the ferroalloys rather loosely and without much regard to their great variation in value and conditions of production. Until 1909 they were classified in this country with pig iron or metals unwrought, and under our present tariff (act of 1913) the iron-manganese alloys are still grouped with pig iron. The ferroalloys, other than these iron-manganese alloys, are given the same ad valorem rate of duty notwithstanding the marked differences obtaining with regard to their trade conditions and the competitive positions of producers.

This treatment of the ferroalloys shows certain existing inconsistencies. Under both the acts of 1909 and 1913, ferrotungsten and ferrovanadium, for example, were subject to the same ad valorem

duties. Both these ferroalloys are made largely by similar manufacturing processes and are dependent in part upon imported raw material. Yet the producers of one of these ferroalloys have met practically no foreign competition and have furnished the world market with the greater part of its supply, while the producers of the other have been seriously menaced by foreign rivalry and only under abnormal conditions have been able to export any of their output. The acts of 1909 and 1913 made no distinction in treatment between spiegeleisen and ferromanganese, and the act of 1913, none between the 10 or 12 per cent grade of ferrosilicon and the 50 and 75 per cent grades. Yet the conditions with reference to the manufacture of standard-grade spiegeleisen and low-grade ferrosilicon vary greatly from those obtaining in the production of ferromanganese and higher grades of ferrosilicon. In the case of the iron-manganese alloys the difference is due mainly to the sources of raw material and in the case of ferrosilicon to processes of manufacture.

Any adequate treatment, therefore, of this group of important industries necessitates a study of their economic situation. Such a study has been made by the Tariff Commission based upon a field investigation which covered the greater part of the United States. Where plants or business offices were not visited information was secured by correspondence. In addition to the data supplied by producers and importers in this country a special agent of the Tariff Commission, who had been sent to England, made an investigation of the production of ferroalloys in that country. Further information was secured from the Continent of Europe, both from published sources and otherwise.

Such a survey has required a study of the technical aspects of the industries covered. In the following report this technique has been included only so far as it served to illustrate, or bring into prominent relief, the tariff problems involved.

On the statistical side of this study trade figures were readily obtainable from the publications of the Bureau of Foreign and Domestic Commerce and from customs officials. Trade publications were also used in gathering price quotations, both in this and foreign countries. These figures were checked up by comparison with those obtained from producers and buyers themselves. War conditions, however, particularly during 1917 and 1918, produced a marked variation between contract and spot prices. The former were characterized by a certain lag in the price changes during the war period, but on account of the large amount of product sold on contract, they represent more accurately than spot prices what producers actually received. At the same time the spot quotations are better reflectors of market fluctuations and more suited for comparison with foreign prices. Producers in other countries are very reserved about giving information concerning the prices they actually receive; and hence to make a comparison between domestic and foreign prices, the quotations in reputable and well-known trade publications, both at home and abroad, constitute the best material which is really comparable.

In making price comparisons consideration must be given to certain artificial conditions existing during and after the war. Thus in England during the war the home prices of articles regarded as neces-

sary were kept artificially low, while export prices responded in large measure to market conditions. From the latter part of 1917 to the end of 1918 a price-regulating policy affecting directly some of the ferroalloys and indirectly others, existed in the United States. In Canada, which is a very large producer and small consumer of ferrosilicon, price quotations are wholly valueless for purpose of determining the market conditions. Home prices have been kept artificially low.

The international exchange situation has to be taken account of in quoting foreign prices and in discussing the competitive conditions. Owing to the depreciation of foreign money, prices in other countries when quoted in their American equivalents should be given according to the current rates of exchange. At certain times shortly after the war the fluctuations in these rates were very pronounced, and hence average monthly and annual prices are difficult to state. Where foreign prices are tabulated the American equivalents are given at the normal rates of exchange and at the approximate averages for the current rates.

One aspect of the foreign exchange situation, about which there is much confusion, is the lag shown in the response to the changed monetary situation of the world on the part of certain regions supplying raw material. Ocean freights measured in terms of gold are pretty much the same for producers in different countries where volume and direction of traffic and length of haul make the services practically identical. It is alleged, however, that the prices of raw material in the regions referred to have not adjusted themselves to changed conditions.[1] In India, New Caledonia, and China the prices of ore used in ferroalloy manufacture seem to be named on the bases of currencies nearer their prewar rates of exchange than market conditions warrant. Other conditions than the rates of foreign exchange are probably accountable, in part at least, for this situation. To the extent that the foreign buyer can purchase his raw material in depreciated currencies on the bases of prewar rates of exchange or more nearly at those rates than present exchange conditions warrant while the American buyer continues to pay in American money, the competitive position of the American producer is altered to the advantage of his foreign competitor.

In determining the importance to be attached to the different items entering into the cost of manufacture it has been necessary to secure cost data from the leading producers of those ferroalloys whose production has become most nearly standardized and which are subject to the greatest foreign competition. These data, however, have not been confined to the grades and kinds which are menaced by such competition. Thus costs were obtained for spiegeleisen and low-grade ferrosilicon, which are not in any way threatened with foreign competition. These cost figures covered a large part of the output of the country. They were classified and averaged in such a way as to show in general the relative importance of the several elements in the expense of manufacture. Some difficulty was experienced in putting the expenditures of some companies under their proper heads and correlating them with expenditures reported by

[1] Charles Hardy, in Engineering and Mining Journal, Jan. 3, 1920, pp. 6-7.

other concerns. Except in the case of ferrotungsten this difficulty was not serious.

Cost figures secured by the Tariff Commission are those furnished by the companies themselves. While these data were carefully scrutinized, a technical cost investigation of the books of the several reporting concerns was not undertaken. Several companies, however, sent copies of their own cost sheets, and all practically vouched for the correctness of the figures supplied.

The cost data secured by the commission covered a period when industrial conditions were in process of readjustment after the war. While these figures are probably different from what they are likely to be when things have become thoroughly adjusted to a peace basis they are not without value in showing the factors determining the competitive position of American producers. It is a matter of vital import whether a manufacturer's raw material constitutes 30 per cent or 80 per cent of his total cost. The competitive strength of an American electric-furnace operator may be one thing if his power expense constitutes only 5 per cent of this total cost and another thing if it is 30 per cent. The main value of these cost data, therefore, is in the determination of the relative importance of the principal items entering into the total expense of production.

The figures obtained from producers as well as the field investigation carried on by the Tariff Commission show that the competitive position of American producers of ferroalloys depends in large part on prices of raw material and on the cost of electric power. As already indicated, the foreign exchange situation affects the cost of the former at American plants when imported. Aside, however, from this situation, ocean freight rates are sometimes more favorable to the foreign producer than to the American. But this is largely a matter of geographical location. While differences in ocean freights on ores used in the manufacture of ferroalloys do affect appreciably competitive conditions, they are not, generally speaking, great enough by themselves to handicap seriously the American producer.

The price of electric power, however, is a very big factor in some of the ferroalloy industries. The manufacture of the higher grades of ferrosilicon requires a large consumption of power, and the price of power is a large item in the total cost. Certain foreign countries by virtue of the combination of certain climatic and topographical conditions have great advantages over the United States in the nature and supply of hydroelectric power. These advantages are being utilized by foreign producers.

Labor cost, while an important item, comprises, generally speaking, a smaller percentage of the total than either raw material or electric power. Wage rates in the United States are materially higher than they are in Europe. Where the blast furnace process is used the difference is usually offset by larger furnaces and greater output per man. In the case of the electric-furnace method equipment, the number of men employed at plant, and the tonnage output per worker pretty closely correspond in the different countries. Hence differences in wage rates reflect variations in labor cost.

Differences in the costs and conditions of manufacture are important in the matter of classification. This is particularly true if specific rates should be substituted for the present ad valorem ones.

The different grades of any alloy vary in value, and this variation is reflected in the prices charged or quoted. In the case of some of the ferroalloys the value of one grade may be several times that of another. The imposition of specific rates, therefore, would necessitate some classification. Such a classification should be based upon alloy content and, in the case of some alloys, upon carbon content. Even if ad valorem rates are retained, the conditions of production with reference to high-grade alloys differ so greatly from those of low grades of the same alloys that factors other than value enter into a proper classification. A good illustration is ferrosilicon, Bessemer ferrosilicon (silicon content 15 per cent or less) being a blast-furnace product and the higher grades (silicon content ranging from 16 to over 90 per cent) being electric-furnace products.

Another matter for tariff consideration is the question of compensatory duties. At present the question does not arise in the manufacture of the ferroalloys, as their raw materials are on the free list. They do arise in the case of alloy steel and will arise in the case of the production of the ferros themselves if certain ores are made dutiable. In the manufacture of any article some material is lost, and this loss has to be taken account of in the successive stages of production.

Efforts have been made to ascertain an approximate average recovery of metal in the manufacture of the ferroalloy out of the ore concentrate and of the alloy steel out of the ferro. It was found that recovery varies greatly with the ores used, processes employed, grades of alloys and alloy steel made, and experience of the labor engaged in manufacture. Only very rough averages could therefore be given.

The revenue aspect of the tariff problem is touched upon in the discussion of the several ferroalloys. The revenue possibilities while moderate in the case of some of these products are not very great in the case of any of them. Some of the ferroalloys are imported only sporadically, and others which have been imported in moderate amounts under the acts of 1909 and 1913 would probably not be imported at all if high rates of duty should be imposed.

On the whole, the investigation of the ferroalloy industries has brought into prominent relief practically all the principal aspects of the tariff problem. The importance of these industries is to be judged not by the quantity and money value of their products alone, but by these in relation to the several larger industries which are dependent upon them for their efficiency and service to the public.

THE FERROALLOYS.

GENERAL DESCRIPTION.

The ferroalloys are special products consisting mainly of iron and some other chemical element whose use in the manufacture of steel serves to give the latter certain desirable qualities. This latter element is usually some metal of higher value than iron and is generally the principal determinant of the price to be charged for the ferro. In addition to the two principal constituents, there is a small percentage of other ingredients of which carbon is usually the most conspicuous. In the case of some ferroalloys the elimination of carbon is sometimes practiced, and this adds materially to the value of such alloys.

The first ferroalloys to be used on any considerable scale were the iron-manganese alloys—spiegeleisen and ferromanganese. Where the manganese content is less than 45 per cent [1] the alloy is known as spiegeleisen, and where it is 45 per cent or more it is called ferromanganese. The standard grade of spiegeleisen is 20 per cent manganese content and that of ferromanganese 76–80 [2] per cent.

Ferrosilicon, which ranks next to the iron-manganese alloys as the most widely used of the ferroalloys, is a combination of iron and silicon, the percentage of silicon content varying from 8 to 90 per cent. Ferrosilicon, with a silicon content of 15 per cent or less, is usually made in blast furnaces, while the higher grades are all made in electric furnaces. The standard grade for electric-furnace ferrosilicon is 50 per cent silicon content.

Other widely used and highly important ferroalloys are ferrochrome with an average chromium content of 60 to 70 per cent, ferrotungsten with a tungsten content running usually from 70 to 80 per cent, ferrovanadium with a vanadium content of 30 to 40 per cent, ferromolybdenum with a molybdenum content varying from 50 to 80 per cent, ferrotitanium with a titanium content of 15 per cent or more, and ferrophosphorus whose phosphorus content ranges from 17 to 25 per cent. Other ferroalloys used in very limited amounts and largely in experimental ways are ferrouranium, ferroboron, ferroaluminum, ferrozirconium, and ferrocerium.

Closely connected with the ferroalloys in character and use are the metals themselves in a practically pure state unalloyed with iron. Tungsten powder, for example, is often used in place of ferrotungsten in the making of high-speed steel. Molybdenum is also

[1] The line dividing spiegeleisen and ferromanganese is a shifting one. Bulletin No. 77 of the Bureau of Mines (p. 142) makes the dividing line 25 per cent manganese content; Tiemann in Iron and Steel (p. 235) 30 per cent; and recent practice among steel and ferroalloy manufacturers, 40 per cent. The War Industries Board, however, classed all these alloys containing less than 45 per cent manganese as spiegeleisen and all having 45 per cent and more ferromanganese. The last classification is the one adopted in this report.

[2] Prior to the war it was 80 per cent. During the war it sunk as low as 60 per cent. It is now (1920) 76 to 80 per cent.

employed largely in its metallic form in place of ferromolybdenum, and aluminum has supplanted ferroaluminum. As a rule, however, the functions for which ferroalloys are manufactured are better performed by these alloys than by the metals themselves in their pure or nearly pure forms.

The uses of the ferroalloys and the significance of the ferroalloy industries will be treated in some detail later. It may be stated here, however, that the ferroalloys perform one or both of two functions—they are purifying or deoxidizing agencies in steel manufacture and they add to the steel elements which will give it certain necessary or desirable qualities. The iron-manganese alloys perform both functions. Spiegeleisen or ferromanganese is used in the manufacture of all steels to do away with "blowholes" or occluded gases and to add some manganese—usually about 0.4 or 0.5 per cent—to the steel. Ferrosilicon is primarily a scavenger or deoxidizing agent, and in this capacity is more powerful than spiegeleisen or ferromanganese. It is also employed sometimes as an alloying agent. Ferrotitanium is used only as a scavenger or cleanser. Ferrotungsten, ferrochrome, ferrovanadium, and ferromolybdenum are employed to add tungsten, chromium, vanadium, and molybdenum, respectively, to the steel.

HISTORY.

The production of ferroalloys assumed importance after the introduction of the Bessemer process of steel manufacture about the middle of the nineteenth century. Some ferroalloys, however, were made in the early years of that century. In 1810 Berzelius obtained an alloy containing 9 per cent silicon from a mixture of iron shavings, silica, and carbon. In 1811 Strohmayer repeated the experiment of Berzelius and prepared a series of alloys containing 2.2 to 9.3 per cent silicon. About 60 years later Valten made ferrosilicon at Terre-Noire, France, by the reduction of iron oxide and silica in a crucible with carbon. The studies of Faraday, Stodarts, and Berthier made ferrochrome familiar after 1820, and 40 years later Baur found that ferrochrome was the best agency for adding chromium to steel. In 1834 Berthier made ferrotungsten with a low percentage of tungsten, and in 1866 Bierman made some of this ferroalloy out of tungsten trioxide and iron in a crucible.

The industrial importance of the iron-manganese alloys began with steel manufacture on a large scale. The Bessemer process which initiated this large-scale production required a strong deoxidizing agent to produce sound steel. In 1866 Prieger of Bonn, Germany, made in the crucible some ferromanganese containing 70 to 80 per cent manganese. At Terre-Noire, France, a little later it was made in the open-hearth furnace and crucible in a combination process.

Before 1870 ferroalloys were manufactured almost entirely in crucibles. In 1873 ferromanganese was made for the first time in a blast furnace in Sweden and contained 33 per cent manganese. In 1875, at Terre-Noire, Pourcel made ferromanganese containing 75 to 80 per cent manganese in a blast furnace. Since that time almost all the ferromanganese produced in the world has been made in blast furnaces. During the last six or eight years a small amount has been manufactured in electric furnaces.

The same year that Pourcel used the blast furnace to produce ferromanganese he succeeded in making 15 per cent ferrosilicon in a blast furnace. Silico-spiegel was also produced at the same time with this process. Thereafter the manufacture of low-grade ferrosilicon, or Bessemer ferrosilicon (silicon content 8 to 15 per cent), in blast furnaces became firmly established. During the last few years much of this product has been made in electric furnaces, but this process is more costly, particularly for grades with a silicon content of 12 per cent or less.

Among other ferroalloys made in blast furnaces during the three closing decades of the nineteenth century was ferrochrome, although a large percentage of this product continued to be made in crucibles. Bierman, of Hanover, in 1873, and later the English firm of Hadfield and the French concern of Holtzer & Co., began to manufacture ferrochrome in commercial quantities. By 1886 the value of chromium in steel had become fairly well understood and several producers entered the field as regular manufacturers.

The electric furnace process, as applied to the manufacture of ferroalloys, was not introduced until the closing years of the nineteenth century. Moissan, in France, made some ferrosilicon and silicides by this method, but the first company to take up the manufacture of this important ferroalloy as a regular business was a small company in West Virginia operating under the Chalmot patents in 1898. In 1899 the carbide industry in Europe began to collapse and the manufacture of ferroalloys by the electric furnace commenced. At Bozel, France, ferrosilicon was made by this process, and electric furnaces were established in other parts of France, and in Germany, Switzerland, Austria, Norway, and Sweden. After 1899 the electric furnace method gradually supplanted the blast furnace and crucible processes in the manufacture of ferrochrome. In 1900 the electric furnace was applied to the manufacture of ferrotungsten, and is now the prevailing one used. Ferrovanadium, ferrotitanium, and the rarer ferroalloys are for the most part made in electric furnaces.

The World War gave a great impetus to the ferroalloy industries, particularly in the United States. In the years immediately preceding the outbreak of hostilities in Europe the United States imported about half the ferromanganese it consumed, the greater part of its electric-furnace ferrosilicon, ferrochrome, and ferrotungsten. Most of the ferrovanadium of the world was produced in the United States, as practically all the raw material was controlled by American interests.

During the war the United States became the world's greatest producer of ferroalloys. The output of ferromanganese came to exceed that of the United Kingdom. While this country continued to import electric-furnace ferrosilicon, the home production of high-grade ferrosilicon increased greatly. The supply of ferrotungsten from Gemany being cut off, this country so augmented its own output as to become for a time an exporter of this alloy and develop into the world's largest producer. The manufacture of ferrochrome also advanced rapidly—imports for a time practically ceasing. Other ferroalloys were also produced in increasing quantities. As a result the United States at the close of the war produced not only a larger tonnage of ferroalloys than any other country, but also a greater variety.

The cessation of hostilities found the ferroalloy industries of the world in a more advanced condition than ever before. There was, however, a considerable slump in the demand for certain alloys, especially for ferrosilicon of the higher grades, ferrochrome, and ferrotungsten. These alloys were used in large amounts in the manufacture of shell steel, armor plate, projectiles, and high-speed tools employed in the production of certain ordnance material. The steel output of the United States also fell off, and this for a time affected the demand for spiegeleisen and ferromanganese. Prices dropped and international competition became keen in several lines. New industrial uses, however, promise to create further demands for the ferroalloys which in the near future will probably equal and even exceed those developed by the war.

SIGNIFICANCE OF THE USE OF FERROALLOYS.

From an economic standpoint two of the most noteworthy developments in the use of metals in recent times has been the increased production and consumption of iron (including steel), and the use of certain alloys which have desired qualities not found or found only in a limited degree in pure metals. The production of steel on a large scale dates from the introduction of the Bessemer process of manufacture about the middle of the nineteenth century. Prior to the middle of last century, iron, while looked upon as a common or "base" metal, was consumed in quantities limited in proportion to its use at the present time. How restricted this use was can be seen by comparing the world's output of iron and steel in terms of pig iron, with the world's population for decennial years from 1800 to 1910 and for the years 1913 and 1918. This tabulation will show the increased output of iron during the past century, both absolutely and in amounts relative to population.

TABLE NO. 1.—*The world's production of iron and steel, in terms of pig iron, 1800–1918.*

Years.	Population of world.	Production of iron and steel in terms of pig iron.	Per capita production of pig iron.	Years.	Population of world.	Production of iron and steel in terms of pig iron.	Per capita production of pig iron.
	Millions.	*Million tons.*	*Pounds.*		*Millions.*	*Million tons.*	*Pounds.*
1800	640	0.8	2.8	1880	1,439	18.0	28.0
1820	780	1.0	2.9	1890	1,488	27.2	41.0
1830	847	1.8	4.8	1900	1,543	40.4	58.4
1840	950	2.7	6.4	1910	1,616	65.8	91.2
1850	1,075	4.7	9.8	1913	1,652	77.9	105.5
1860	1,205	7.2	12.6	1918	1,699	62.0	81.7
1870	1,310	11.9	20.4				

There was little change in the per capita production of iron during the first two decades of the nineteenth century, a considerable growth during the next three decades, and a marvelous increase of output after 1850. The apparent falling off after 1913 was due to war conditions and to incomplete figures from some of the leading countries producing iron and steel. If the figures for per capita production were limited to the leading commercial and industrial nations of the world, they would illustrate the development of the iron and steel industry after the introduction of the Bessemer process in a still more striking manner. In the United States, for example, the output of

pig iron from 1850 to 1918 increased from 563,755 to 39,054,644 long tons, or from a per capita production of 54.4 pounds in 1850 to a per capita output of 833 pounds in 1918. Thus while the per capita output of the world in 1918 was approximately nine times that of 1850, the corresponding production of the United States was 15 times that of 1850. This increase for the United States would be still greater if scrap iron and steel, which to some extent takes the place of pig iron in steel manufacture, were added.

A greater part of the pig iron now produced is manufactured into steel. This increased steel output has been made possible by the introduction of the Bessemer and later the open-hearth processes of manufacture. The steel, however, made by these processes is rendered defective by the occlusion of gases and the presence of other oxides unless deoxidizing agents are employed. The existence of these gases or "blowholes" rendered the manufacture of high-grade steel impossible.

The first agent employed on any large scale in the purification or deoxidation of steel was iron-manganese alloy in the forms of spiegeleisen and ferromanganese. Spiegeleisen or ferromanganese is now employed in the manufacture of all steels, and some concerns use no other ferroalloys in the manufacture of ordinary carbon steel, except on special order. Other ferroalloys more powerful as deoxidizers than the iron-manganese alloys mentioned were discovered, and one of these, ferrosilicon, is employed in the making of practically all kinds of steels.[1]

Another, and increasingly important, use of the ferroalloys is in the manufacture of alloy steels and irons. The increased use of alloy metals resulted from the recognition that metals of absolute purity are not so desirable as those alloyed with certain other metals or elements. In ancient and mediæval times pure metals as derived from minerals were practically unknown, save a few important exceptions like the pillar of pure iron at Delhi, India, which is now over 1,600 years old.[2]

Metallurgical processes in the past were so crude that it was not possible to produce pure copper, pure nickel, or pure zinc or cast alloys of constant composition. During the past 100 years, especially within the last 50, metallurgical processes so improved that metals could be produced of a purity never before attainable.

It wasn't long, however, before it was found that "100 per cent purity" is not always desirable. For example, pure nickel could not be rolled into sheets and drawn into wire without excessive breakage, and consequently a small percentage of manganese had to be added to render the nickel workable. Tungsten with one-half to 1 per cent thorium makes a better flame than "100 per cent pure" tungsten. Iron containing a small percentage of copper or larger percentages of silicon or chromium corrodes less than pure iron.

Experimentation soon showed that the addition of certain elements to steel gave it desirable qualities of first importance in the development of a number of our capital industries, such as the machine industry, the electrical industry, and the automobile industry. These industries are largely if not wholly dependent upon alloys now produced for the most part by electro-thermic processes. Among

[1] Some steel companies still use very little ferrosilicon, but the tendency is toward a larger employment of the alloy.
[2] Chemical and Metallurgical Engineering, Sept. 8, 1920, p. 471.

these products are ferrotungsten, with 70 to 80 per cent tungsten, used in the manufacture of high-speed steels and magnet steels; ferrosilicon, of great value in the manufacture of silicon iron used in electrical apparatus; ferrovanadium, with 30 to 40 per cent vanadium, a necessary addition to steels used in automobile construction where high tensile strength and resistance to constant vibrations are demanded; and ferrochrome, with 60 per cent or more chromium, used for chrome-nickel and chrome-vanadium steels, armor plate, stainless steels, tool steels, and other products.

The purification and alloying of steel are best performed by ferro alloys, although in some cases, as has already been indicated, these functions can be carried out by the use of certain metals or elements in a pure state. The demand for ferroalloys has resulted in the growth of an important group of manufacturing industries. This growth has taken place during the last 40 or 50 years—most of it within the last 20 years.

In addition to the metallurgical significance of the growth of the ferroalloy industries during the past few decades, their development in the United States during the World War, and their importance in the manufacture of military supplies call for some mention. As has already been pointed out, the World War greatly stimulated the growth of the manufacture of ferroalloys in the United States. After the outbreak of hostilities in Europe, and especially after this country entered the war on the side of the Allies, several new companies started to manufacture ferrosilicon, ferromanganese, ferrotungsten, ferrochrome, and other alloys by the electric-furnace method. Other concerns already in the business extended their plant equipment—in some cases at the instance of the Government. The war closed before some of these plants and extensions had become well established, and as a result they have suffered certain industrial setbacks, partly on account of the lessened demand for ferroalloys immediately after the close of hostilities, with many cancellations of orders, and partly because of increased importation of the foreign product.

The military value of some steels is greatly enhanced by the use of certain ferroalloys. Ferrosilicon is essential to the manufacture of shell steel or shrapnel, the silicon when added in sufficient quantity making the steel breakable into a number of pieces. It is the chromium, which is added by means of ferrochrome, that makes armor plate so hard and resistant to shock. Tungsten is indispensable to the manufacture of high-speed steel; and modern high-speed steel tools with 400 to 700 per cent efficiency as compared with the old carbon-steel tools were of inestimable value during the war.

PRODUCTION OF FERROALLOYS IN THE UNITED STATES.

Statistics regarding the output of ferroalloys in the United States are incomplete, and in several instances, unsatisfactory. The records of certain companies show only the value of their output, and reported figures from these concerns are based upon prices received and grades manufactured. In some other cases output is indicated only in quantities of the more valuable metal in the alloy produced, e. g., the amount of ferrotungsten manufactured would be shown not in units of ferro but in those of tungsten content. One ferroalloy, ferrosilicon, so varies in content and method of manufacture that published figures of total production are not of great value. Further-

more, some of the rarer ferroalloys are entirely, or almost entirely, produced by single concerns whose individual outputs would be indicated by the publication of the totals of such alloys.

Tolerably accurate figures of the output of spiegeleisen and ferromanganese are now published in the annual statistical reports of the American Iron and Steel Institute. Similar figures regarding ferrosilicon are also published in these reports, but they are incomplete and based in part upon estimates. Unfortunately no distinction is made between blast furnace and electric furnace ferrosilicon, nor, as already stated, are the widely varying grades produced divided into classes. With reference to other ferroalloys, no figures are published by the American Iron and Steel Institute, although records of such production are kept.

While incomplete and in other respects unsatisfactory, these statistics do give some indication of the growth of ferroalloy production in this country from prewar times to the present. Figures published by the American Iron and Steel Institute for the years 1912 to 1919, inclusive, show the estimated output in the United States of ferromanganese, spiegeleisen, and ferrosilicon. To these figures are added the totals for other ferroalloys which were compiled by the institute for use of the Tariff Commission. These figures are given in Table No. 2.

TABLE NO. 2.—*Production of ferroalloys in the United States, 1912–1919.*

Years.	Ferro-manganese.	Spiegel-eisen.	Ferro-silicon.	Other ferro-alloys.[1]	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1912	125,378	96,346	104,017	16,837	342,578
1913	119,495	110,338	105,715	12,435	347,983
1914	106,083	79,935	136,514	11,419	333,951
1915	149,521	97,885	131,617	12,401	391,424
1916	221,532	194,002	234,360	22,148	672,042
1917	260,125	192,985	242,462	27,700	723,272
1918	333,027	283,853	297,940	38,930	953,750
1919	185,357	84,246	181,751	21,202	472,556

[1] Figures obtained by United States Tariff Commission from manufacturing companies indicate rather larger production of "other ferroalloys." The figures, however, from the American Iron and Steel Institute do indicate generally the relative proportion of "other ferroalloys" to total output.

It will be noticed in the above tabulation that the iron-manganese alloys—ferromanganese and spiegeleisen—constitute considerably over one-half of the ferroalloys produced. This is due to their universal use in steel manufacture. The ferrosilicon output is also indicative of a large use in iron and steel production.[1] The output included under the head of "other ferroalloys" embrace ferrochrome, ferrotungsten (including tungsten powder, but not metallic tungsten in rod form), ferrotitanium, ferrovanadium, ferromolybdenum, ferrophosphorus, ferrozirconium, ferrouranium, and ferrocerium. All of these ferroalloys are produced in relatively limited quantities and most of them are high in value.

A more detailed tabulation, which includes values as well as quantities, is published by the Geological Survey [2] and shows "an

[1] Some of the largest producers of electric furnace ferrosilicon do not report their output to the American Iron and Steel Institute and hence estimates are made for these nonreporting concerns. It has been contended by electric furnace producers that lumping together all grades of ferrosilicon—from 8 per cent to 90 per cent silicon content—practically nullifies the value of all figures on ferrosilicon published by the Institute.

[2] Iron Ore, Pig Iron, and Steel in 1918, by Ernest F. Burchard, pp. 570 and 571. This publication is part of Mineral Resources of the United States, 1918, Part I.

complete outline of the shipments of ferroalloys in the United States in 1914, 1915, 1916, 1917, and 1918," as follows:

TABLE NO. 3.—*Ferroalloys of domestic manufacture shipped, 1914–1918.*

Variety of alloy.	1914		1915		1916	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
Ferromanganese	100,731	$4,440,253	144,260	$9,253,443	224,103	$30,123,493
Spiegeleisen	76,625	1,586,139	114,556	2,403,550	182,837	6,158,202
Ferrosilicon	77,182	1,621,830	128,263	2,595,265	166,308	5,273,088
Ferrophosphorus					12,966	
Ferrotungsten (50 per cent or more tungsten)	(1)	(1)	(1)	(1)	(1)	(1)
Other varieties [2]	986	1,702,023	1,565	3,198,127	3,524	8,726,909
Total	255,524	9,350,245	388,641	17,450,385	589,738	50,281,692

Variety of alloy.	1917		1918	
	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*	
Ferromanganese	290,225	$53,936,771	306,076	$69,015,678
Spiegeleisen	189,241	9,756,236	263,861	17,276,494
Ferrosilicon	175,079	8,562,182	171,756	11,864,904
Ferrophosphorus				
Ferrotungsten (50 per cent or more tungsten)	1,258	4,225,070	2,142	7,798,898
Other varieties [2]	8,218	7,257,465	7,033	9,447,969
Total	634,021	83,731,724	750,868	115,433,943

[1] Included with "Other varieties."

[2] "Other varieties" include, in 1914 and 1915, ferromolybdenum, ferrotungsten, and ferrovanadium; in 1916, ferrochrome, ferromolybdenum, ferrotungsten, and ferrovanadium; in 1917, ferrocerium, ferrochrome, ferromolybdenum, ferrocarbontitanium, ferrouranium, and ferrovanadium; and in 1918, ferrocarbontitanium, ferrocerium, ferrochrome, ferromolybdenum, ferrotitanium, ferrouranium, ferrovanadium, and ferrozirconium.

The figures published by the Geological Survey include only shipments, and hence are smaller than those of the American Iron and Steel Institute. Separate figures are given for ferrotungsten, but not for ferrochrome, the output of which is much larger. The bulk of the ferrochrome produced in the United States, however, is the output of a single company, while the manufacture of ferrotungsten is pretty well distributed among several concerns. The shipments of ferrophosphorus are combined with those of ferrosilicon except in the year 1916. They form a small percentage of the combined total and are almost entirely those of a single concern.

The value of ferrotungsten and "other varieties" of ferroalloys is much greater in proportion to the amounts produced than that of ferromanganese, spiegeleisen, or ferrosilicon. Thus in 1918 while the country's shipments of ferrotungsten amounted to less than three-tenths of 1 per cent of the total shipments of all ferroalloys as computed by the Geological Survey, their value was nearly 7 per cent of the total.

No attempt was made by the United States Tariff Commission to secure complete statistics for all the ferroalloys, as several of the smaller producers which had flourished during the war period went out of business shortly after the signing of the armistice and their records were unobtainable. Furthermore, figures secured for ferromanganese and speigeleisen by the American Iron and Steel Institute are believed to be sufficiently complete and accurate to render unnecessary any additional effort to obtain other totals. The figures for ferrosilicon, while based in part upon estimates, are sufficiently close to indicate the country's production of all grades of this alloy.

The commission did, however, attempt a statistical investigation of the output of electric-furnace ferromanganese and ferrosilicon in order to estimate what proportion of each of these ferroalloys is produced in electric furnaces. This proportion was small in the case of ferromanganese, amounting to about 3 per cent of the total output in 1918 and 1 per cent of the total in 1919. Electric-furnace ferrosilicon constituted about 40 per cent of the country's total in 1918 and about 30 per cent in 1919.

Figures were obtained concerning the output of ferrochrome and ferrovanadium. While several concerns produce each of these alloys, the bulk of the output of each is manufactured by a single company or interest, and hence can not be given separately.

GEOGRAPHICAL DISTRIBUTION.

The geographical distribution of plants manufacturing ferroalloys is determined mainly by the cost of raw materials and the price of power. When the blast-furnace method of manufacture is employed, the cost of coke is the chief factor of consideration in locating the plant. Where the price of electric power is a large item in the cost of production, as in the case of certain grades of ferrosilicon, there is a marked tendency to gravitate to regions in which relatively low-priced hydroelectric power can be obtained. In some cases the location of certain ore deposits determine the position of the ferroalloy plant.

The distribution in 1918 and 1919 of plants manufacturing ferroalloys among the different States is shown as follows:

Number of places, by States, in which ferroalloys were manufactured in 1918 and 1919.

State and alloy.	Number of places.	
	1918	1919
Alabama:		
Ferromanganese	3	3
Spiegeleisen	3	3
Ferrosilicon	0	1
Ferrochrome	0	1
Ferrophosphorus	0	1
California:		
Ferromanganese	2	1
Ferrosilicon	1	0
Ferrochromium	0	1
Ferromolbydenum	1	0
Colorado:		
Spiegeleisen	1	1
Ferrosilicon	1	1
Ferrochromium	1	1
Ferrotungsten	2	1
Illinois:		
Ferromanganese	1	1
Spiegeleisen	1	1
Ferrosilicon	1	1
Iowa:		
Ferrosilicon	1	1
Maine:		
Ferrosilicon	1	1
Maryland:		
Ferrochromium	1	1
Ferrosilicon	1	1
Ferrotungsten	1	0
Montana:		
Ferromanganese	1	1
New Jersey:		
Ferromanganese	1	0
Ferrochromium	1	1
Ferrotungsten	1	1
Ferrotitanium	1	1
New Jersey—Continued.		
Ferrozirconium	1	1
Ferrovanadium	1	1
New York:		
Ferromanganese	2	1
Ferrosilicon	8	8
Ferrocarbontitanium	1	1
Ferrotungsten	1	1
Ferrochrome	2	2
Ohio:		
Ferrosilicon	4	4
Oregon:		
Ferromanganese	1	0
Pennsylvania:		
Ferromanganese	12	12
Spiegeleisen	11	11
Ferrosilicon	1	1
Ferrocerium	1	1
Ferrochromium	1	1
Ferromolbydenum	2	2
Ferrotungsten	4	4
Ferrouranium	1	1
Ferrovanadium	5	5
Tennessee:		
Ferrosilicon	3	2
Ferrophosphorus	1	1
Virginia:		
Ferromanganese	3	2
Spiegeleisen	3	2
Ferrochrome	1	1
Washington:		
Ferromanganese	1	1
West Virginia:		
Ferrochrome	1	1

The plants manufacturing ferromanganese and spiegeleisen in Pennsylvania are all blast-furnace plants and are so located on account of the proximity of coking coal. The ferromanganese plants of Montana, California, Oregon, and Washington all use electric furnaces and have cheap hydroelectric power. Blast-furnace ferrosilicon (grades 8 to 15 per cent silicon) is manufactured in Ohio, Pennsylvania, and Illinois, but the electric-furnace product is mainly the output of plants in the Niagara Falls district of New York. Some electric-furnace ferrosilicon, however, is produced at Keokuk, Iowa; Baltimore, Md.; Anniston, Ala.; Rumford, Me.; Plattsburg, N. Y.; and Chattanooga, Tenn. At all these points hydroelectric power is employed in whole or in part. Ferrochrome, in the manufacture of which the cost of electric power is an important item, also tends to seek the Niagara Falls region, where power is relatively cheap. The manufacture of ferrotungsten is largely concentrated in Pennsylvania, where the market for this alloy is largest and not far from the ports at which most of the foreign ores are landed, the price of tungsten-bearing ores being by far the most important item in the cost of producing ferrotungsten and tungsten metal. The manufacture of ferrocarbontitanium consumes a great amount of power, and hence the location of the plant producing this alloy at Niagara Falls. The ferrotitanium manufactured in New Jersey is the carbon-free product made by the thermit process. Ferrophosphorus is produced in Tennessee and Alabama, largely on account of the accessability of raw material. The location of most other plants manufacturing ferro-alloys is determined by marketing conditions or the accessibility of material for experimental purposes.

The factors determining the location of plants within the United States play an important part in deciding the competitive strength of American as against foreign producers. Differences in method of production and in the relative importance of the several items entering into cost of production cause great variation in the conditions which enable manufacturers to produce most economically and to meet foreign competition. These conditions will be discussed when the ferroalloy industries are treated severally.

ORGANIZATION AND CAPITALIZATION.

The proper equipment of a ferroalloy plant requires considerable capital and in some cases an investment running into the millions of dollars. Over 95 per cent of the ferromanganese and all the spiegeleisen of the country are produced in blast furnaces. An up-to-date blast furnace with necessary auxiliaries represented before the war an investment of $750,000 to $1,000,000. To-day (1920) the building and proper equipment of such a furnace costs from $2,000,000 to $3,000,000. Many blast furnaces are not so expensively built and equipped, but the figures cited show the large capital necessary to secure the most economical production.

The longevity of a blast furnace employed in the manufacture of ferromanganese, measured in terms of tonnage output, is only about one-seventh that of a furnace used in the production of pig iron. In other words, a blast furnace continuously producing ferromanganese lasts about one-half as long as one devoted to pig iron and manu-

factures about two-sevenths as much per day. The allowances for depreciation and renewals must therefore be larger than in the case of pig iron.

The amount of capital necessary to equip an electric furnace for the manufacture of ferrosilicon, ferrochrome, or ferrotungsten is not so large as that required for the building of a properly equipped blast furnace. These alloys are generally produced on a much smaller scale than ferromanganese and spiegeleisen. During the war electric furnaces with electric transformers and other auxiliary attachments were built at a cost of $100,000 and even less. The larger plants, however, usually have more expensive furnaces, each plant having several in continuous operation. While several concerns are capitalized at a few hundred thousand dollars, some of the largest companies are capitalized at $1,000,000 to $4,000,000.

Most producers are simply manufacturers and sellers of ferroalloys. Some, however, mine their own ores. Thus a few of the producers of tungsten metal and ferrotungsten own deposits of tungsten-bearing ores which formerly were the principal sources of their supply of raw material. The American Vanadium Co. controlled the output of vanadium ore in Peru, the principal source of the ferrovanadium produced in the world. When the Vanadium Corporation of America was formed in 1919 the American Vanadium Co., with its Peruvian holdings, was taken over by that organization.

It is impossible to make any exact estimate of the total amount of capital invested in the manufacture of ferroalloys and of the capital invested in the production of each ferroalloy. Most large manufacturers make more than one alloy, and any division of investment among the different classes of products must be arbitrary. Some producers are also manufacturers of other products. Thus manufacturers of ferromanganese, spiegeleisen, and Bessemer ferrosilicon are largely producers of pig iron and other products. The same furnace which at one time is used for the manufacture of ferromanganese or spiegeleisen will be employed at another in the production of pig iron. The allocation of the capital invested in the blast furnace between pig iron and the iron-manganese alloys would be very difficult.

The manufacturers of ferroalloys using the electric furnace, crucible, and thermit processes are, for the most part, confined to this branch of manufacture and have been able to make a report to the commission of the capital invested in ferro-alloy manufacture alone. The reports from 25 companies using the processes named show an investment of approximately $25,000,000.[7] Included in this figure is some idle capital representing plants which have temporarily discontinued business, but which are expected to be put into operation again in the near future.[8] It should be remembered that the figure given here does not include the much larger investment in the manufacture in blast furnaces of spiegeleisen, ferromanganese, and ferrosilicon.

The capital necessary to equip a modern ferroalloy plant is not in itself large enough to restrict production to a small number of manufacturers. In some lines, however, partly on account of the recent

[7] One concern producing ferrophosphorus by the blast-furnace method is included in the above computation.

[8] Capital invested in plants which have permanently ceased doing business or are now engaged in other branches of industry are not included in the above estimate.

development of the industry and partly because of the control of the sources of raw material, certain manufacturers produce the greater part of the ferroalloys made in the United States. Over half of the ferrochrome and electric-furnace ferrosilicon output of the United States in 1918 was produced by one company. All but a small fraction of the country's output of ferrovanadium is produced by a single organization. Some of the ferroalloys still in an experimental stage, like ferrouranium, are made by single concerns. In these cases the cost of laboratory equipment and expenses generally figure as an important item in total costs. The production of ferromanganese and spiegeleisen requires large capital, but the country's output is distributed among several companies. The largest producer, the United States Steel Corporation, has controlled from a little over a third to a little over one-half of the country's production, the proportion having declined during the war. The figures for the four war years and 1919 are as follows:

TABLE No. 4.—*Production of spiegeleisen and ferromanganese by the United States Steel Corporation compared with that of the United States, 1915–1919.*[1]

	1915	1916	1917	1918	1919
Production of United States Steel Corporation, gross tons	107,558	170,526	168,846	224,036	153,322
Production of all other companies.....gross tons..	139,848	245,008	284,264	392,844	116,281
Total production of United States.....do....	247,406	415,534	453,110	616,880	269,603
Percentage of United States Steel Corporation.....	43.47	41.04	37.26	36.32	56.87

[1] Annual Statistical Reports of the American Iron and Steel Institute for 1916, 1918, and 1919, pp. 68 and 69.

The percentage of the United States Steel Corporation for 1919 is larger than it has been for many years. This large proportion is probably due to the great depression in the industry immediately after the signing of the armistice, which affected independent manufacturers more than the Steel Corporation itself. Furthermore, while the United States Steel Corporation has sold some ferromanganese, its production is almost entirely utilized in its own plants.

There is no intrinsic tendency in the ferroalloy industries toward monopoly. With the exception of vanadium ores, there is no control exercised by any one interest over the supply of raw material in the case of the more important and widely used ferroalloys. Where electric power is used the price charged is usually regulated by public service commissions according to locality and amounts used. In some regions, notably at Niagara Falls, certain companies enjoy lower rates for power by virtue of old contracts entered into when power was cheaper than now. With the lapse of the periods covered by these contracts the rates will be put on the same basis as those for other companies. This differential, however, does favor at present the concerns having the lower power rates. On the whole the ferroalloy industries are highly competitive. There are, however, conditions which give some groups of producers differential advantages over other groups, but these advantages are mainly matters of geography and will receive attention in the treatment of the various ferroalloys.

PRICES.

The prices of the various ferroalloys are quoted according to standard grades and, in the case of some alloys, by the amount of the more valuable metal contained in the alloy. Ferromanganese, spiegeleisen, ferrosilicon, ferrocarbontitanium, and ferrophosphorus are sold by the ton with the standard grades expressed in percentages of manganese, silicon, titanium, or phosphorus. The price of ferrochrome is often quoted in Europe by the ton, but in this country, by the pound of contained chromium. The same method of quotation obtains with reference to ferrotungsten, ferrovanadium, ferromolybdenum, and minor ferroalloys. Ferrochrome and ferrotungsten are graded not only with respect to their chromium and tungsten contents respectively but also with regard to their carbon content, the price tending to rise as this content diminishes. Small amounts of "carbon-free" ferrochrome, ferrotungsten, ferrovanadium, and ferrotitanium are manufactured by the aluminum process. These alloys are quoted at higher prices than the grades with a larger carbon content.

The greater part of the more commonly used ferroalloys are sold on contract, and hence during a period of violent price fluctuation such as occurred during the war there would be a considerable discrepancy in some instances between quotations in the spot market and the prices at which a large part of the ferroalloys are actually sold. This was particularly true of the ferrosilicon and ferrochrome sold in this country during the years 1917, 1918, and 1919. Prices are sometimes quoted, f. o. b. furnace, and sometimes at principal markets for ferroalloys in this country. Where importations are large, as was the case with ferromanganese before the war and as is now (1920) the case with ferrotungsten, the principal quotations are at Atlantic seaboard points.

Price quotations in the United States and Europe show the same general trend, but some alloys are on the whole quoted lower in Europe than in this country. The difference in some cases is sufficient to cause a considerable importation. In the case of only one ferroalloy, ferrovanadium, are prices sufficiently low in this country compared with those prevailing abroad to lead to any substantial exportation.

IMPORTS AND EXPORTS.

Prior to the war a large proportion of the more widely known ferroalloys consumed in the United States was imported.

About one-half of the ferromanganese used in this country in the years just prior to the war was imported, mostly from England. During the war the percentage of imported material declined considerably, partly because of a falling-off in imports and partly on account of a great increase in domestic production. In 1918 only about 10 per cent of the domestic consumption was imported. In 1919, however, imports increased while the domestic output declined.

The importation of spiegeleisen is small compared with domestic production. In 1910 and 1911 about a fifth of the amount consumed in this country was imported. Since that time, however, the imported material has constituted a very much smaller proportion of this total.

While most of the ferrosilicon used in this country is produced at home, a large proportion of the electric-furnace grades (grades containing a silicon content of over 15 per cent) is imported. Nearly all the imported material comes from Canada, although prior to the war Sweden contributed an appreciable quantity. Since the signing of the armistice there has been a considerable amount of ferrosilicon with a silicon content of 15 per cent and less imported from Canada. This material while usually made in blast furnaces can be manufactured in electric furnaces, and this Canadian material is an electric furnace product.

Ferrochrome and ferrotungsten were imported in relatively large amounts before the outbreak of the war, most of the former coming from France, and nearly all of the latter from Germany. More ferrochrome was produced at home than was imported in the years immediately preceding the war, but practically all the domestic output was manufactured by one company. During the war imports of both ferroalloys declined to almost nothing. Of late (1920) there has been a revival of the import trade, most of the foreign ferrochrome coming from France as in the years before the war, and the greater part of the imported ferrotungsten from England.

Very little ferromolybdenum and ferrovanadium have been imported in recent years, except in 1919 when a phenomenally large importation of the former (including molybdenum metal) occurred. The importation of ferrophosphorus is limited compared with the domestic output, and that of titanium and ferrotitanium, small and sporadic.

With the exception of ferrovanadium the ferroalloys are either not exported at all or in limited amounts. In 1913 and 1914 about one-third of the domestic output of ferrovanadium was exported and in 1917 nearly one-half. During the last two or three years of the war some ferromanganese and ferrotungsten were exported in response to heavy war demands. There were also some exports of Bessemer ferrosilicon.

The details of the trade situation with reference to the ferroalloys will be taken up under the heads of the separate alloys. It may be said in general that, in the years immediately preceding the war, about one-third to two-fifths of the ferroalloy tonnage consumed in this country was imported. In terms of value about one-half was imported.

TARIFF HISTORY.

The comparatively recent development of the ferroalloy industries accounts for the late mention of their products in the tariff laws of the country. Spiegeleisen is mentioned in the act of 1883 where it is classed with "iron in pigs, iron kentledge, * * * wrought and cast scrap iron, scrap steel," etc., and bears a duty of "three-tenths of 1 cent per pound." Ferromanganese and ferrosilicon are first mentioned in the law of 1890, and these alloys and spiegeleisen are grouped with "iron in pigs, iron kentledge," etc., and carry a duty of "three-tenths of 1 cent per pound."

The acts of 1894 and 1897 name the same alloys and group them in the same way as the law of 1890. The rate of duty in each law is reduced to $4 per ton. In none of the acts referred to are the other

ferroalloys specifically named. The raw material of ferrochrom[illegible] "chromate of iron, or chromic ore"—is mentioned in the laws of 1[illegible] 1894, and 1897. In the first a rate of "15 per centum ad valore[illegible] was imposed, and in the last two the ore was placed on the free [illegible] In all three of these acts cerium is also referred to and placed on [illegible] free list.

In the act of 1909 a special paragraph is devoted to the ferroalloy[illegible] with the exception of ferromanganese and spiegeleisen, which a[illegible] still classed with "iron or pigs," etc. This paragraph is numbere[illegible] 184 and reads as follows:

> Chrome or chromium metal, ferrochrome or ferrochromium, ferromolybdenum, ferrophosphorus, ferrotitanium, ferrotungsten, ferrovanadium, molybdenum, titanium, tantalum, tungsten, or wolfram metal, valued at two hundred dollars per ton or less, twenty-five per centum ad valorem; valued at more than two hundred dollars per ton, twenty per centum ad valorem; ferrosilicon containing not more than fifteen per centum of silicon, five dollars per ton; ferrosilicon containing more than fifteen per centum of silicon, twenty per centum ad valorem.

This paragraph is the first in any of our tariff acts to enumerate the ferroalloys usually produced at the present time in electric furnaces and the metals themselves unalloyed with iron. A noteworthy distinction is made between ferrosilicon produced in electric furnaces (ferrosilicon containing more than 15 per cent silicon) and ferrosilicon manufactured for the most part in blast furnaces (silicon content 15 per cent or less). This distinction is of great importance, particularly where specific rates are imposed.[9]

The duties on ferromanganese and spiegeleisen in the act of 1909 were reduced from $4 to $2.50 per ton.

The act of 1913 imposed a uniform ad valorem rate of 15 per cent upon all the ferroalloys except spiegeleisen and ferromanganese. The enumeration of the ferroalloys is the same as in the act of 1909 except that ferrosilicon is mentioned with the other alloys instead of being specified separately, and all grades bear the same percentage of duty. There is also the addition "and other alloys used in the manufacture of steel, not specially provided for in this section" (see par. 102). Spiegeleisen and ferromanganese are placed on the free list in a paragraph with iron ore, iron in pigs, wrought iron and scrap and scrap steel, iron in slabs, blooms, etc.

FOREIGN TARIFFS.

In foreign countries where ferroalloys are produced and import duties levied, the rates are usually specific, occasionally a combination of specific and ad valorem duties. In very few are these alloys specifically mentioned, and in none is the great variation in alloy content, and consequently in value, logically provided for in the rates imposed. Thus in the French tariff ferrosilicon with a silicon content of 89 per cent, has the same specific rates as ferrosilicon with a silicon content of 20 per cent, notwithstanding the fact that the market value of the former is usually two and a half to four times that of the latter.

In several countries rates vary within limits according to treaty agreements. France has what is called the maximum and minimum tariff system, wherein are fixed by law the general (maximum) and

[9] See below under "Ferrosilicon."

mum rates within which actual rates may be determined by arrangements with other countries. Germany has the general nventional system in which are fixed by the national legisla- eneral rates, from which reductions may be made on certain by executive authority in return for similar favors from other es. Canada has a threefold system of import duties—the preferential, the intermediate, and the general. The first is ble to goods imported from the United Kingdom and most arts of the British Empire;[10] the second, to commodities from es, including parts of the British Empire not enjoying the preferential rates, which in the judgment of the governor in have extended satisfactory benefits to Canada; and the third, les coming from all other countries.

e United Kingdom the ferroalloys are admitted free of duty. len spiegeleisen, ferromanganese, ferrochrome, wolfram, iron, er nonmalleable kinds of iron and iron alloys, not specially ed, are admitted free. So also are ferrosilicon and ferrosilico- ese containing not more than 15 per cent of silicon. When con or ferrosilico-manganese contains more than 15 per cent he rate is 7 kroner per 100 kilograms, or $0.85 per 100 pounds. German tariff the ferroalloys are not specifically mentioned, re is a provision which includes the ferroalloys imposing a ler its general tariff of 1 mark per 100 kilograms, equivalent ar times to $0.11 per 100 pounds,[11] on "pig iron and nonmal- on alloys." Under this provision an exception is made in of "ferrosilicon (iron containing silicon) of a tenor in silicon r cent or more," which in cases of conventional arrangement ted duty free. (See pars. No. 777 and 317.)

Canadian tariff specifically enumerates only ferromanganese, isen, and ferrosilicon. On the iron-manganese alloys a rate per ton plus 7½ per cent ad valorem was imposed in 1918 be intermediate and general tariff, and a rate of $1.50 per er the British preferential tariff when these alloys contained e than 15 per cent manganese. Where the manganese con- s more than 15 per cent, ferromanganese and spiegeleisen mitted free under the British preferential tariff and carried a 7½ per cent ad valorem under the intermediate and general The rates on ferrosilicon were the same for the alloy con- 15 per cent or less silicon as for the corresponding grade of -manganese alloy just mentioned. For ferrosilicon containing an 15 per cent silicon, however, the rate under the British tial tariff was $3 per ton, and under the intermediate and tariffs $4.50 per ton plus 7½ per cent ad valorem.

French tariff specifically enumerates ferromanganese, ferro- ferrochromium, ferrotungsten, ferromolybdenum, ferrotita- nd ferrovanadium. There is, in addition, the provisional or "all other ferro metallic alloys containing rare elements, an those mentioned above." The rates under the general 1920, with their American equivalents at the normal rate nge, are as follows:

, for example, is not included among the parts of the British Empire enjoying the British ates.

nal rates of exchange are assumed in all cases where American equivalents are given.

French tariff on ferroalloys (general tariff).

Articles.	French currency (per 100 kilograms).	Am cur (pe pou
	Fr. c.	
Ferromanganese containing more than 25 per cent and less than 90 per cent of manganese	5 25	
Ferrosilicon containing more than 5 per cent and less than 20 per cent silicon	5 25	
Rich silico-spiegel iron containing at least 20 per cent of silicon and of manganese	5 25	
Ferrosilicon containing 20 per cent or more but less than 90 per cent silicon	7 50	
Ferrochromium containing more than 10 per cent and less than 90 per cent chromium	12 00	
Ferrotungsten containing more than 5 per cent and less than 90 per cent tungsten	30 00	
Ferromolybdenum containing more than 5 per cent and less than 90 per cent molybdenum	30 00	
Ferrotitanium containing more than 5 per cent and less than 90 per cent titanium	30 00	
Ferrovanadium containing more than 5 per cent vanadium and all other ferrometallic alloys containing rare elements other than those mentioned above—silicon, manganese, chromium, titanium, tungsten, molybdenum metals (90 per cent or more of these elements)—ad valorem, 7½ per cent.		

The above rates are those of the general or maximum tariff. rates in the minimum tariff are one-third less.

TARIFF PROBLEM.

The tariff problem connected with the manufacture of ferroall is primarily concerned with competitive conditions, and these v for the most part with the source and importance of the raw mat and the method of production. These are treated with some de in the following discussion of the several ferroalloys. It may be s however, by way of introduction to this phase of the subject that competitive strength of the different ferroalloy industries in United States varies in a marked degree. It depends mainly u the price and accessibility of raw material and the process use manufacture. Labor cost, while far from being a negligible facto subordinate in importance to the two mentioned.

With reference to raw material, the United States is self-suffic in its supply of coal and coke and a few of the ores used in the ma facture of ferroalloys. It also has a limited supply of other which are, or can be, utilized in the production of alloys, but the is great, and in some case the material is inferior to the impo product. The United States, for example, is self-sufficient v regard to molybdenite, the ore employed in the manufacture of fe molybdenum, but is obliged to depend upon foreign sources for n of its high-grade manganese ores used in the manufacture of fe manganese because of the very limited deposits of such ores in country. Where ores are imported their costs are influenced by s factors as expense of mining, ocean freight rates, rail charges f mines to port of shipment and from port of entry to furnace of ma facturer, and the rates of foreign exchange. Where the pric imported ore forms a large percentage of the total cost of manu ture, as is the case with several of the ferroalloys, these influences important in deciding the competitive strength of producers.

With respect to process of manufacture, the cost of converting material into ferroalloys is relatively low in the case of some fe alloys and high in the case of others. This difference depends u method of manufacture. Most of the ferroalloys made in this cou

are manufactured either in blast furnaces or in electric furnaces. Where the former method is used the conversion cost is as low in this country as in any other. Where the electric-furnace process is employed the conversion cost in the United States is higher than in some other countries. This higher cost in the case of the electric-furnace method is due to greater price paid for the use of electric power. Where electric power forms a large proportion of the total cost of manufacture producers endeavor to secure hydroelectric energy, whose price is usually much less than that paid for steam-generated electricity. Hydroelectric power, however, is cheaper in some countries, like Canada, Norway, Sweden, and France, than in the United States. Where the cost of power is a large part of the total expense, as in the case of the higher grades of ferrosilicon, this difference affects the competitive position of the American producer.

In addition to the phase of the problem involved in the competitive situation of ferroalloy manufacturers there are the questions concerned with classification, the relative merits of specific and ad valorem tariff rates, compensatory duties, and revenue possibilities. With reference to the first attention has been called to the former classification of ferroalloys with pig iron, both in this and foreign countries. This classification is unfortunate. The value of ferromanganese, which is still grouped with "iron in pigs" in the present tariff in force in this country, depends upon its manganese and not its iron content. The tariff problem affecting this ferroalloy has to do primarily with manganese and not iron. A similar observation applies to such alloys as ferrochrome, ferrotungsten, ferromolybdenum, and ferrovanadium. In this connection, too, where process of manufacure varies with the grade of alloy produced, as is the case of ferrosilicon having a silicon content of 15 per cent or less and the alloy having a higher silicon content, or where the source of raw material may differ, as in the case of the iron-manganese alloys, spiegeleisen, and ferromanganese, the variation means that the tariff problem is not the same in these different grades, and this fact merits consideration in the classification with respect to duties imposed.

The question of the advisability of imposing ad valorem or specific rates is partly an administrative one, but not entirely so. Where an ad valorem rate is based upon the wholesale price prevailing in the primary markets of the exporting country, the latter when it exports the bulk of a given commodity which it produces may find it good business policy to reduce the amount of such duty by establishing an unduly low price at home and selling at a relatively high price in the country to which the commodity is exported. This possibility exists in the case of at least one of the ferroalloys which is now being imported in large quantities from a country which consumes but a small fraction of its output.[2] Such a situation calls for the consideration of either a new basis for imposing ad valorem duties or the imposition of specific rates.

The matter of compensatory tariff rates is a vital one where an article in passing from raw to finished product is subject to successive duties. In passing from one stage of production to another some loss is generally involved. This loss varies greatly with the kind of ore used, process employed, grade of product, etc., and is very hard to

[2] See below under "Ferrosilicon."

state with any degree of precision. Nevertheless some allow must be made, if duties are imposed upon the raw and crude mat as well as the finished product. Under the present (1913) tariff question is not an important one in the manufacture of the f alloys as the raw material in all cases is admitted free. It is, how important in the manufacture of alloy or special steels.

The revenue possibilities of the ferroalloys are not great, alth in some cases they are appreciable. The importation of ferro ganese, ferrosilicon, and ferrotungsten is sufficiently large u ordinary conditions to yield a fair revenue. At present the fir these alloys is on the free list, but when it was dutiable the rev was considerable.

The position of the various ferroalloy industries in the U States and the tariff problems involved will be discussed under following heads:

1. Iron-manganese alloys.
2. Ferrosilicon.
3. Ferrochrome.
4. Ferrotungsten.
5. Ferrovanadium.
6. Ferromolybdenum.
7. Ferrotitanium.
8. Ferrophosphorus.
9. Minor ferroalloys.

IRON MANGANESE ALLOYS.

DESCRIPTION.

The iron-manganese alloys are the most important of the ferroalloys. They consist of spiegeleisen and ferromanganese,[1] the principal ingredients of which, as the names indicate, are iron and manganese. When an iron-manganese alloy contains less than a given percentage of manganese it is called spiegeleisen, and when it contains this percentage or more it is denominated ferromanganese. The dividing line between spiegeleisen and ferromanganese has been changed from time to time. Formerly the dividing line was placed at 20 and 25 per cent manganese content; later, 30 per cent was accepted as the line of division; and now (1920) the practice is to call all iron-manganese alloys having 40 or 45 per cent manganese content and more, ferromanganese, and lower grades, spiegeleisen. The 45 per cent line of division, which was the one adopted by the War Industries Board, is the one used in this report.

Standard ferromanganese at the outbreak of the war was usually guaranteed to average 80 per cent or above manganese, and spiegeleisen from 18 to 22 per cent (commonly 20 per cent). In 1918, on account of the scarcity of good manganese ores, 70 per cent (at one time 60 to 65 per cent) ferromanganese became virtually the standard in American and British markets. Standard spiegeleisen also suffered some deterioration, but as lower-grade ore is used in the manufacture of this iron-manganese alloy the reduction was not so marked. At present (1920) standard ferromanganese contains 76 to 80 per cent manganese [2] and spiegeleisen about 20 per cent manganese.

The bulk of the spiegeleisen and ferromanganese produced in this country tends to be of the standard grades. Hence the change in the dividing line between spiegeleisen and ferromanganese from a manganese content of 25 per cent to one of 45 per cent does not materially change the statistics of output of these two grades of iron-manganese alloys. There is a small amount of alloy manufactured, principally in the Rocky Mountain region, which is affected by this change.

Other ingredients of spiegeleisen and ferromanganese are carbon and small amounts of silicon, phosphorus, and sulphur. The usual range in percentages of elements entering into the standard grades of ferromanganese and spiegeleisen is indicated as follows:

	Ferromanganese.	Spiegeleisen.
	Per cent.	*Per cent.*
Silicon	0.50–3.00	1.00–3.00
Sulphur	Under .04	Under .05
Phosphorus	.10–.35	Under .25
Total carbon	5.00–7.00	5.00–6.00
Manganese	60.00–82.00	15.00–30.00
Iron by difference		

[1] Ferrosilico-manganese is also an alloy which may be grouped in this class of ferroalloys. Practically speaking, it is not used in this country.

[2] There is a marked effort to have the standard grade raised to 80 per cent and above as an average. Grades below 80 per cent are not entirely suited to the specifications made for open-hearth steel.

Uses.—Both ferromanganese and spiegeleisen are used in the manufacture of steel and perform similar functions. They are both deoxidizing and alloying agents. They were the first alloys to be used on a large scale for deoxidizing molten steel, and to-day are not infrequently the only ones so used.[3] The amount of ferromanganese necessary to perform this service and add a small amount of manganese to the steel (about one-half of 1 per cent) is around 17 pounds to 1 long ton of steel. During the war a smaller amount was employed, sometimes as little as 10 pounds. Spiegeleisen in order to do the same amount of work must be added in much larger quantities.

The addition of manganese to the steel is an important function performed by these alloys. Under present metallurgical methods it is impossible to produce a high grade of steel without adding on the average 0.4 to 0.6 per cent of manganese. In some special steels, the manganese steels, as much as 12 or 13 or even 15 per cent of manganese is added, usually by high-grade ferromanganese. The manganese in proper proportion gives strength and durability to the metal, and these qualities are at their maximum when the steel contains about 12 or 13 per cent manganese[4] and 1.5 to 2 per cent carbon. Manganese steel is costly and hence is employed only for special purposes, such as the jaws and wearing parts of rock-crushing machinery, railroad frogs and crossings, railroad rails on curves, mine-car wheels, and burglar-proof safes.

Another function performed by the iron-manganese alloys relates to the carbon content of the steel produced. All steels require a certain percentage of carbon, which must be added in a definite amount readily controlled to produce steel of the required hardness. Ferromanganese or spiegeleisen is a medium used to restore this carbon. Spiegeleisen is employed for high-carbon or hard steel, but is unsuited for low-carbon or soft steel, as one unit of manganese obtained from standard spiegeleisen adds about three or four times as much carbon as one unit obtained from standard-grade ferromanganese. Ferromanganese is the alloy used in making soft steel. It is also employed for the most part when the open-hearth process is used. Spiegeleisen is generally employed in making Bessemer steel.

RAW MATERIALS.

In the manufacture of ferromanganese in a blast furnace the furnace is charged with high-grade manganese ore and sufficient iron ore, pig iron, or scrap iron to make a product containing about 80 per cent manganese and 10 to 15 per cent iron.[5] In the production of spiegeleisen a mixture of iron ore and manganese ores or manganiferous ores [6] is used. In addition to these materials limestone and coke are employed, the former as a flux and the latter as a fuel.

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[3] One large manufacturer of steel informed an expert of the commission that ferromanganese is practically the only ferroalloy his company ordinarily uses for deoxidizing and alloying steel. Ferrosilicon is employed when specified, but not otherwise. It was found, however, that other steel producers were disposed to use other alloys as well for deoxidizing purposes.

[4] Bureau of Mines: Bulletin No. 77, pp. 144 and 145. When steel contains more than 1 per cent and less than 7 per cent manganese it is hard and rather brittle. New qualities appear when the manganese content reaches 7 per cent. Toughness, as well as hardness, begins to appear, and these qualities reach their maximum when the steel contains 12 to 15 per cent manganese.

[5] It is assumed here that the desired grade of ferromanganese is the grade containing 80 per cent manganese. The proportion of iron would, of course, be larger in the 70 or 60 per cent grades.

[6] Ores containing manganese are divided into four classes depending upon the amounts of manganese and other metallic contents: (1) Manganese ores with high manganese content (35 to 50 per cent); (2) manganiferous iron ores; (3) manganiferous silver ores; and (4) manganese zinc residue. Only the first is used in making ferromanganese.

The coke consumed in the manufacture of a ton of ferromanganese is much larger than in the production of an equivalent amount of pig iron and is an appreciable item in the conversion cost. The amount varies considerably, but with up-to-date and efficiently managed furnaces the coke consumption per ton of ferromanganese produced will range from 4,400 to 5,600 pounds. Producers with inadequate experience or equipment will use from two to four times these amounts.

Based upon figures given for a charge in a certain furnace in Pennsylvania, the amounts and proportion of raw materials necessary to make 1 ton (2,000 pounds) of 80 per cent ferromanganese are as follows:

Raw material.	Quantity.	Per cent (exclusive of pig iron, iron ore or scrap, and air.)
	Pounds.	
Manganese ore (manganese over 48 per cent)	5,000	39.08
Stone (limestone or calcite and raw dolomite)	1,912	14.94
Coke	5,882	45.98
Total	12,794	100.00

With this raw material should be added iron ore, scrap iron, or pig iron to reduce the percentage of manganese and add iron. The proportion used varies with the material, being larger in the case of iron ore than in the case of pig iron or scrap iron, and larger for low-grade ore than for high-grade ore. Another addition to the raw material is 10 or 11 tons of air.

A small percentage of the ferromanganese produced in the country is made in electric furnaces. Coke is used in such furnaces not as a fuel but as a reducing agent, and hence is consumed in much smaller quantities. Other materials used in the charge are manganese ore, iron ore, lime rock, charcoal, and fluorspar.

With the exception of high-grade manganese ores, all the raw material above mentioned entering into the manufacture of ferromanganese and spiegeleisen are obtained in large amounts and at relatively low prices in the United States, and domestic producers rely almost entirely upon the home supply. Low-grade manganese ores and manganiferous ores are also abundant in this country and are used in the manufacture of spiegeleisen. Rich manganese ores, however, are found only to a limited extent in the United States, and these ores are required for the production of high-grade ferromanganese (75 to 85 per cent manganese content), which is usually preferred by the steel maker.

In the three or four years immediately preceding the war only about 1 per cent of the high-grade manganese ores used in this country was of domestic origin. These ores came almost entirely from British India, Russia, and Brazil. Since 1914 Brazil has been the principal source of supply for the imported product. Importation from Cuba also increased. During the war domestic ores were utilized to a great extent on account of the difficulty and expense of securing the foreign product.

The economical utilization of manganese ores depends upon a high manganese and a low silica content. The lower the iron and phosphorus contents the better will be the ore, other conditions being the same. Good manganese ores will run 48 per cent or more manganese content and less than 8 per cent silica. According to one large producer of ferromanganese, domestic ores generally run below 48 per cent manganese content, and on large shipments from 40 to 45 per cent. The silica content runs 6 per cent and above, generally 8 to 12 per cent. Foreign ores, on the other hand, run 48 per cent manganese or better, while the silica content is generally below 8 per cent. In contracts for the purchase of ore there is a penalty if the silica content is above 8 per cent or the manganese below 48 per cent. This producer was extremely conservative in his statement regarding domestic ores, as figures taken at random for a number of shipments show a somewhat lower average for manganese content than the above statement would indicate and a decidedly higher average silica content. Another large producer gives the following as a typical analysis of ores, domestic and foreign, used in the manufacture of ferromanganese:

Analyses of ores in dry state.

Ores.	Manganese.	Iron.	Silica.	Phosphorus.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brazilian ore	46.84	4.80	5.00	0.031
Indian ore	51.60	5.89	6.52	.093
Caucasian ore	50.00	1.25	9.00 to 10.25	.17
Domestic ore (average of best quality)	40.75	3.38	12.21	.067

This producer further states:

In comparison with foreign ores, American ores are scanty in tonnage (far from adequate to meet domestic consumption), are high and irregular in silica, relatively low in manganese, and normally much higher in cost at the consuming point, due to the initial high cost of production and the high freight rates. The principal tonnages of ores in the United States containing manganese are manganiferous iron ores, which are not desirable nor suitable for the manufacture of standard ferro, and in many instances are not suitable for making spiegel because of high phosphorus. The manganiferous ores also as a rule are high and irregular in silica. There are no large known deposits of high-grade domestic manganese ores comparable with foreign ores. The use of domestic ores simply exhausts what high grade ore there is, rather than increase[s] by development of larger reserves.

It should be observed that Indian, Caucasian (Russian), and Brazilian ores have a higher manganese content and a lower silica content than American ores. On account of their low iron content Caucasian ores were formerly mixed with Indian and Brazilian ores in American and British furnaces.

The large use of Caucasian and Indian ores made possible a high-grade alloy. Since 1914 the supply of Caucasian ores has been almost entirely shut off, and on account of transportation difficulties the amount of Indian ores received both in England and the United States has been inadequate. The lack of a sufficient supply of manganese ores from Russia and to a considerable extent from India probably accounts for the lower average grade of the ferromanganese manufactured to-day compared with that produced before the outbreak of the war.

EQUIPMENT AND METHOD OF PRODUCTION.

The equipment used in the manufacture of spiegeleisen is the blast furnace with its auxiliaries. Most of the ferromanganese produced in the United States is also made in blast furnaces. A small percentage in recent years has been made in electric furnaces. Production by the latter, however, is more expensive than by the blast-furnace process, and when the price of ferromanganese falls to a low level the electric-furnace product to a large extent ceases to be produced.[7] The electric furnace, while more expensive, can utilize ores containing a higher percentage of silica than can the blast furnace.

The blast furnace used for the manufacture of spiegeleisen and ferromanganese is essentially the same as that employed in the production of pig iron. It is often employed at different times in the making of these ferroalloys and of pig iron. As has already been noted,[8] the manufacture of ferromanganese in place of pig iron reduces the life of a blast furnace about one-half in point of time and approximately six-sevenths in terms of tonnage output. The ordinary daily production of one of the largest furnaces in the world visited by a representative of the Tariff Commission is about 120 tons. Its highest recorded daily and monthly output is respectively 178 tons and 4,521 tons. Such a furnace devoted to pig iron would produce three and one-half times as much in the same length of time and last twice as long.

Regarding the relative merits and wastes of the blast-furnace and electric-furnace methods of manufacture, a published statement makes the following declaration:[9]

> The usual manufacture in blast furnace is wasteful of both fuel and manganese; the furnace must be run hot and slowly, with very hot blast in order to reduce the manganese in the ore as completely as possible and not waste manganese in the slag. Yet in spite of all efforts, from 15 to 25 per cent of the manganese going into the furnace escapes reduction and is lost in slag. This waste of fuel and manganese has led to the use of the electric furnace, in which fuel is required only as a chemical reagent and not to produce heat, thus saving about two-thirds the fuel requirements of the blast furnace, while the higher temperature available causes the extraction of manganese to reach 90 per cent., i. e., slag losses to be down to 10 per cent or less. Against these economies must be set the considerable expense for electric power, and the smaller scale on which the furnaces run.

The expense of power and the smaller scale of operation do more than offset whatever advantages the electric furnace has over the blast furnace. At the present stage of metallurgical progress the electric furnace can not compete with the blast furnace in the manufacture of ferromanganese. One advantage not alluded to in the above quotation which the electric furnace apparently has over the blast furnace and which may be of considerable importance at some future stage is the possible utilization of manganese ores whose silica contents render them unfit for the blast furnace.

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[7] A company having a large electric-furnace plant in the West for the manufacture of ferromanganese ceased production shortly after the signing of the armistice when the price of ferromanganese dropped from $200 per gross ton to a little over $100 per gross ton. With the rise of price in 1920 this company resumed production. Some other companies having electric furnaces either went out of business or turned to the manufacture of other ferroalloys.

[8] Pp. 33-34.

[9] Journal of Commerce, Sept. 28, 1918.

METALLIC RECOVERY.

The manufacture of ferromanganese and spiegeleisen from manganese or manganiferous ores involves some metallic losses. It is a matter of importance to take account of such losses in view of the fact that they are of vital concern whenever the question of compensatory tariff rates arise. Unfortunately only rough general estimates can be made as these losses vary with the ores used, the process employed, and the experience of the producer.

With reference to the ores used, the recovery of manganese in the manufacture of ferromanganese depends largely upon the silica content. The higher the silica content the more manganese will be lost. The average recovery in blast furnaces when good manganese ores are used, i. e., ores containing 6 per cent or less silica and 48 per cent or more manganese, is about 80 per cent in good practice. Very seldom, with even the highest grade ore and the best practice, does it get above 85 per cent.

During the war experiments were made to ascertain metallic losses in the making of ferromanganese and spiegeleisen from ores then available. Twelve furnaces, producing about 40 per cent of the country's output of ferromanganese, showed a metallic loss of manganese in the manufacture of this alloy of 29 per cent. The manganese loss in the manufacture of spiegeleisen was 38 per cent.[10] It should be stated, however, in this connection that the ores used were largely American, whose silica content is relatively large.

The process employed in the manufacture of ferromanganese also influences the percentage of recovery. Less metallic manganese is lost on the average in the electric furnace than in the blast furnace. It is claimed that this loss can be reduced to 10 per cent by the use of the electric-furnace method, but figures obtained on the Pacific coast show a larger loss. One of the leading concerns in that region manufacturing ferromanganese in 1918 reported a metallic loss of manganese in the manufacturing process of 30 per cent. This loss, however, was much larger than the average. The manufacture of ferromanganese in electric furnaces is too limited and recent to admit of any categorical statement. Furthermore, the ores used in these furnaces are mainly American and therefore of lower average grade than the foreign ores employed in blast furnaces.

Practice and experience count for much in metallic recoveries. There is a great variation in the percentage of loss among new and old producers. As a rule the former show a larger percentage of loss than the latter. One of the largest and oldest manufacturers reported that its "average practice in a blast furnace shows that about 17½ per cent of manganese contained in the ore is entirely lost during the process of manufacture into ferromanganese."

All steel contains some manganese, and in the manufacture of steel some manganese loss is incurred in adding ferromanganese in the ladle or furnace.[11] But even here there is considerable variation, according to the steel made and process used. The recovery of metallic manganese in the making of soft or low-carbon steel is less than n the production of hard or high-carbon steel. It is also less in the

[10] Figures furnished by Dr. H. W. Gillette, of the Bureau of Mines.
[11] Where the furnace is large, the ferro is usually added in the ladle, but where it is smaller it is added just before it is about to be poured.

open-hearth and Bessemer furnaces than in the crucible and electric furnaces. One large producer reported a metallic manganese loss of 30 per cent from ferromanganese to steel in the open-hearth furnace and 45 per cent in the Bessemer furnace. It was explained that the large loss in the Bessemer practice was due to the fact that the steel made was especially soft, and hence oxidation was naturally increased. A rough average of the recovery of manganese from ferromanganese in steel manufacture would be about 70 to 75 per cent in the case of open-hearth furnaces and 80 per cent in the case of crucible furnaces.

In view of the small amount of ferromanganese used in ordinary steel manufacture—about 17 pounds to a ton of 2,240 pounds—the question of compensatory duties is not serious for ordinary carbon steel. In the case of manganese steel, however, it is a much more important matter of consideration. It is the manganese in such steels that give them their value.

In the manufacture of manganese steel by the electric-furnace process the metallic recovery from the ferro is over 80 per cent. One large producer using this process reported that in making 12½ per cent manganese steel sufficient ferromanganese is used to make 15 per cent manganese steel if no metallic loss occurred in the operation. In other words, about one-sixth of the manganese used in making this steel is lost.

In the open-hearth furnace the loss of metal in alloy steel is greater than in the electric furnace, amounting on the average from 25 to 30 per cent.

GEOGRAPHICAL DISTRIBUTION AND DOMESTIC CONSUMPTION.

Pennsylvania leads all other States in the manufacture of ferromanganese and spiegeleisen. In 1918 ferromanganese was reported to have been made at 27 localities in the United States and spiegeleisen at 19 places; 12 of the places producing ferromanganese and 11 of those making spiegeleisen were located in Pennsylvania. The proportionate output of the Pennsylvania furnaces is greater in each case than the number. Other important States manufacturing the iron-manganese alloys are Illinois, Alabama, and Virginia. Some spiegeleisen or low-grade ferromanganese is manufactured in Colorado. Most of this product is made in blast furnaces. Some electric-furnace ferromanganese is made in Alabama, Montana, and Washington. Electric-furnace ferromanganese was made in California and Oregon in 1917 and 1918, but this production has ceased for the present (1920) in the former State and probably permanently in the latter.

The proximity of coking coal and the location of steel plants account for the large production in Pennsylvania. Coke is an important item in the expense of manufacture by the blast-furnace method, and its shipment long distances to other parts of the country would add materially to this cost. Where ferromanganese is shipped a long distance, especially by rail, the cost of transportation is an important item in its price. The location of furnaces, therefore, near consumers reduces the marketing expense. The plants on the Pacific coast manufacturing ferromanganese have been handicapped by the expense of shipping this product to the great steel centers of the Middle West and East on account of this transportation expense.

An additional reason for the growth of the industry in Pennsylva is nearness to ports at which manganese ores from abroad are land

The bulk of the spiegeleisen and ferromanganese produced in t United States is consumed near the places of production. Very li additional spiegeleisen is imported from abroad, and practically n is exported. The consumption of that iron-manganese alloy in t country is therefore about the same as its domestic output.

The consumption of ferromanganese, however, has always be greater than the domestic production, and in the years immediat before the war was about double that output. The following tab shows the approximate consumption of ferromanganese from 1912 t 1919, inclusive:

TABLE NO. 5.—*Approximate consumption of ferromanganese in the United States, c endar years 1912–1919.*

Year.	Domestic production.	Imports.	Exports.	Approximate domestic consumption.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*
1912	125,378	99,137	.....	224,
1913	119,495	128,070	.....	247,
1914	106,083	82,997	.....	189,
1915	149,521	55,283	.....	204,
1916	221,532	90,928	.....	312,
1917	240,125	45,381	2,400	283,
1918	333,027	26,906	3,577	356,
1919	185,357	33,022	2,999	215,

During the war the proportion of the foreign material consumed in the United States declined. The above figures, however, show that it is still considerable and that only a very small percentage of the domestic output goes abroad.

FOREIGN PRODUCTION.

Statistical data with reference to the production of the different ferroalloys in foreign countries are difficult to obtain. Published statements usually group the ferroalloys with pig iron or under heads which include all or several of these alloys. The statistical figures for iron and steel published by the National Federation of Iron and Steel Manufacturers, of the United Kingdom, group spiegel, ferromanganese, ferrosilicon, and other alloys in one total. In Germany the ferroalloys are lumped together under the caption of steel pig. In the United Kingdom, however, the ferromanganese output constitutes the bulk of the ferroalloy production, and hence figures for totals are some indication of that country's output of ferromanganese. This production for the years 1916, 1917, and 1918 amounted, respectively, to 291,845 gross tons, 296,524 gross tons, and 246,943 gross tons.[12] Of the 1918 figure, 23,078 tons consisted of ferrosilicon and 216,500 gross tons of ferromanganese.[13] The remaining 7,000 tons consist of silico-spiegel and some other alloys.

[12] National Federation of Iron and Steel Manufacturers: Statistical Report, 1918, p. 1. Also Mineral Industry, 1918, p. 394.

published figures for Germany are too inclusive to be of any for this report. That country manufactures both ferroman- and spiegeleisen, and the output is known to be large. In the period German ferromanganese came in limited quantities to ited States, but was much inferior to the British product, as ined a larger percentage of phosphorus.

h iron manganese alloys and metallic manganese.—Before the at Britain was the world's largest producer of ferromanganese, ufactured spiegeleisen only sporadically. A large proportion British ferromanganese is exported, much of it going to the States. There is little demand for spiegel among British rs and what production is carried on is for local consumption. manganese is also produced in Great Britain in electric . The output is largely if not wholly consumed by British kers in the manufacture of castings. The manganese content lloy varies from 50 to 75 per cent and the silicon content to 35 per cent. Silico-spiegel is also manufactured, for the t, in electric furnaces, but in a blast furnace by one company. y, containing 10 per cent silicon and 18 to 20 per cent man- s wholly consumed in the United Kingdom.

on should be made in this connection of metallic manganese, also produced in small amounts in Great Britain. Until this article was the carbon-free metal which was too expensive extended use in steel manufacture. One company, however, eeded in producing metallic manganese of 93 to 97 per cent nd containing from 1½ to 2½ per cent carbon, which can be at a price substantially below that for the carbon-free Like the carbon-free metal, it is made by the Goldschmidt but manganese dioxide suitable for dry batteries is used of the highly purified oxide.

ferromanganese and smelting practice.—British ferroman- the only iron-manganese alloy which comes into competition American product. The following is a typical chemical as given by Tiemann [14] of the 80 per cent grade produced country just prior to the outbreak of war:

	English.	American.		English.	American
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
.....	80.50	80.20	Phosphorus.....	0.23	0.16
rence.....	11.50	12.18	Sulphur.....	.....	Trace.
.....	1.65	.66	Carbon.....	6.78	6.80

1914 the standard grade of ferromanganese, as has already ted, suffered deterioration, the reduction in manganese con- 0 per cent and even less having taken place in both countries. resent time 76 to 80 per cent manganese is standard in both .

es for ferromanganese were given to a special agent of the Tariff Commission who had been nd.

Iron and Steel, p. 233. In Tiemann's figures for English ferromanganese the total is 0.66 e 100, an occasional result of complete chemical analyses.

Until very recently British ferromanganese was considered by American steel producers superior to the domestic product, and there are still a few who adhere to this opinion. This attitude, however, seems to be influenced by the reputation which the English alloy enjoyed in the past and by local conditions.[15] American steel producers generally find the products of the two countries having the same grade practically equal in service, and the price being the same, are indifferent to which they use. One importer states that the English ferromanganese stands storage better than the American, but in other respects there is no essential difference.

While silico-manganese and silico-spiegel are made in electric furnaces the entire British output of ferromanganese is a blast furnace product. Furnaces used in making this alloy are alternatively employed in making pig iron, and their design conforms to the modern developments of smelting pig iron in Great Britain. The usual height of a British furnace is 80 feet. Such a furnace will produce 1,200 to 1,500 tons of pig iron per week from 30 per cent iron ore. In making ferromanganese the output is reduced to 420 to 520 tons per week.

The coke consumption ranges from 2 tons 5 hundredweight (5,040 pounds) to 2 tons 15 hundredweight (6,160 pounds) per ton of alloy made. The lower figure is for the best Durham coke. It is doubtful if there are furnaces at which as little as 2 tons (4,480 pounds) are required.[16]

Where Indian ores are used the yield of ferromanganese ranges from 50 to 52 per cent of the weight charged. The extraction of manganese is therefore between 75 and 80 per cent. Slags are kept extremely basic, and this serves to lower the manganese content, increase the temperature of the furnaces, and helps greatly to remove sulphur and phosphorus.

British producers.—The British output comes almost wholly from six companies, all of which are represented by selling agents in the United States. These companies with their addresses are listed as follows:

Darwen & Mostyn Iron Co. (Ltd.), Darwen, Lancashire.
Wigan Iron & Coal Co. (Ltd.), Wigan, Lancashire.
Bolckow-Vaughn & Co. (Ltd.), Middlesbrough.
Workington Iron & Steel Co. (Ltd.), London.
Linthrope-Dinsdale Smelting Co. (Ltd.), Middleton.
Carlton Iron Co. (Ltd.), London.

All the above companies except the Carlton Iron Co. (Ltd.) are members of the Association of Ferromanganese and Spiegeleisen Manufacturers. This association was organized about 1888, and its activities are apparently confined to fixing prices. It is not strictly speaking a cartel, as it has not a central selling organization. The Carlton Co. ordinarily bases its prices on those fixed by the association, but in times of depression has been known to quote lower.

All the ferromanganese firms make pig iron, and hence it is a simple matter to change a furnace for making ordinary pig iron to producing ferromanganese. It is necessary, of course, to remove accretions and residual material that would contaminate the product, and the lining must be carefully done in order to withstand the higher

[15] One steel producer told an agent of the commission that his company had found English ferromanganese superior to American. He relied, however, almost entirely upon one or two local manufacturers of this alloy who had just entered the field for his supply of the domestic material.

[16] Paul M. Tyler: Ferromanganese Practice in Great Britain. Iron Age, Sept. 16, 1920. Pp. 711–713.

temperature required to make the ferro. However, the same equipment and blast pressure are maintained as in the manufacture of basic pig iron.

According to a statement issued in 1917 (Iron and Steel Trades after the War) the associated firms employ in the trade a total capital of £1,250,000.

Manganese ores used by British producers.—British ferromanganese producers are dependent upon imported ore. Prior to the war this ore came chiefly from India, the Caucasus, and Brazil. During the past couple of years practically all the manganese ores used by ferromanganese producers have come from India.

Manganese ores used by ferromanganese makers and chemical firms in the United Kingdom are bought in London. The mining companies of India have their own agents and ship direct, thus obviating the difficulties of rupee exchange and variations in the delivered cost due to changing freight rates on future contracts. The three largest direct agents for Indian manganese ore in London, in order of their importance, are: (1) Central Provinces Prospecting Syndicate, which is also a mining company; (2) Killick, Nixon & Co. (Nixon, Forrest & Co., London), agents for the Central India Mining Co., The Shivrajpur Syndicate, and the largest native exporter; and (3) The Indian Manganese Co. (Grace Bros., London).

Of a total annual export of approximately 600,000 tons, the three firms above mentioned handled more than 500,000 tons. Almost half of the last amount is handled by the Central Provinces Prospecting Syndicate. Some ore is sold in Bombay for American consumption. This ore is chiefly the product of the India Manganese Co.

India ore is sold on the basis of 50 per cent manganese content, which, however, is generally exceeded to some slight extent. The average analysis of five cargoes shipped in 1919 and amounting to 1,000 tons was as follows:

	Per cent.
Manganese	53.81
Silica	8.35
Iron	4.95
Phosphorus	.149
Moisture	.18

The phosphorus is always fairly low, but the iron frequently exceeds the above figure, and British manufacturers have difficulty in making 80 per cent ferromanganese from this ore. The standard British ferromanganese, which is made from this ore, is 76 to 80 per cent manganese content, averaging 77 per cent manganese.

Most of the Indian ores are shipped through the port of Bombay, although a small amount goes through Calcutta. The mines supplying manganese ores are capable of practically unlimited production for many years to come. Hand labor is largely used, but there is ample equipment at the mines to handle a much larger output than is now produced. During the war period freight rates by rail from mines to port remained practically constant, 8 rupees ($2.5952) per ton. On January 1, 1920, the rate was raised to 10 rupees ($3.244).

Of late there has been considerable congestion on India railways due to the shortage of many thousands of cars. This congestion has seriously affected the available supply of this ore, of which there were stocks of 74,374 tons at Calcutta and 9,000 tons at Bombay in

July, 1920. It is reported that provision had been made for the riage of 500 tons daily to Bombay.[17]

Ocean freight rates to Great Britain late in 1919 and early in 1 ranged from 65 to 85 shillings per ton. Before the war they w about 5 shillings. Prior to 1914 much of the manganese shipped f India went as ballast in both tramp vessels and liners at extre low rates. This situation, according to reports from England longer exists and there is small prospect of its return. An impo phase of the shipping situation is the change in the constructio steamers now operating in the Indian trade. A large part of exports of India consists of seeds, jute, and similar material, of w the weight bears a comparatively small ratio to bulk. Since ma nese ore averages 17 cubic feet to the ton, it is quite possible to from 1,000 to 5,000 tons in the bottom of the hold and then load with seeds or other light material, which goes on a measurement basis.[18] The vessels designed of late for the trade with India built for carrying seeds, jute, and the like and no longer require or heavy ballast. Manganese ore freights are still based on wei but are no longer relatively as low as when they went by ballast.

The price of Indian manganese ore at the beginning of 1920 approximately 3 s. 2 d. per unit [19] (22.4 pounds).

Under normal conditions the cheapest supply of manganese comes from the Caucasus. The deposits in this region are extra dinarily high grade, and of great extent. An important feat of this Caucasian material is its extremely low iron content. Sh ments over a long period to Great Britain have averaged only 0.45 cent iron.

The Caucasus deposits are located east of Batoum, a Black S port, from which the ore is shipped to Great Britain and ot countries. On account of the disorganization of the Tschchiat Railway, the export taxes of the Georgian Government, and alleged enormous wages demanded by miners, very little of thi now (1920) received in Great Britain.

While some Brazilian ore is shipped to Great Britain, the amo is not large. Most of this ore goes to the United States.

Iron-manganese alloys in other countries.—Spiegeleisen and fe manganese are made in other countries, particularly Germany. has already been indicated these products are grouped together w other alloys under the caption of steel pig in the published figure output. The ferromanganese is of lower average grade than British and less in amount. The output of spiegeleisen, however large.

In other European countries the output of the iron-mangan alloys is relatively small, the amounts consumed in steel manufact being imported from the two countries named.

A small amount of ferromanganese is produced in Canada in elec furnaces, but not enough for domestic consumption.

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[17] American Metal Market, Sept. 27, 1920.

[18] Ocean freight goes on either a weight or measurement ton basis. When going by the former the is figured according to weight; when going by the latter, according to space occupied. The measure ton the world over is equivalent to 40 cubic feet.

[19] The unit is 1 per cent of the ton.

PRICES.

The prices of spiegeleisen and ferromanganese are quoted per gross ton, and depend upon the amount of manganese in the alloy in each instance. Quotations for spiegeleisen are based upon a manganese content of 16 to 22 per cent, averaging about 20 per cent. During the war the average grade of spiegeleisen was reduced slightly, but this deterioration was not so marked as in the case of ferromanganese.

Ferromanganese is quoted for the standard grade, which prior to the war was guaranteed to average 80 per cent manganese or more. During the war, on account of the difficulty of obtaining good ore, the manganese content in the standard grade of ferromanganese was reduced. In 1918 70 per cent ferromanganese became standard. At the present time (1920) the standard grade of ferromanganese, both in the United States and Great Britain, contains 76 to 80 per cent manganese.

Spiegeleisen in the United States is sometimes quoted f. o. b. works, and sometimes with Pittsburgh or Philadelphia as a base. In either case the price of spiegeleisen for other parts of the country tends to be the prices at furnaces in Pennsylvania plus cost of transportation.

Ferromanganese is generally quoted in the Pittsburgh, Philadelphia, and Baltimore markets. Before the war the United States Steel Corporation produced a large part of the domestic output, and this was consumed in its own steel furnaces. Two-thirds or more of the remaining ferromanganese used in this country was imported, and was nearly all received at the ports of Philadelphia and Baltimore. Prices were thus quoted at these ports, and prices for other parts of the country, excepting the Gulf and Pacific coast regions, were the Baltimore and Philadelphia prices plus cost of transportation. The small amount of ferromanganese consumed near the Gulf and on the Pacific coast costs the steel producer less than in regions far in the interior, on account of the comparatively cheap water haul to coastal points from England. English ferromanganese was sometimes shipped to San Francisco Bay in California by way of the Gulf and the rail haul to the coast. This ferromanganese sells in California at lower prices than it would ordinarily sell at if it were shipped from North Atlantic ports, or even from Pittsburgh or Chicago, by rail across the continent.

During the war prices at Pittsburgh and Chicago tended to become practically equal to those at Philadelphia and Baltimore. The domestic output was increasing, and the foreign supply became a less important factor in the American price situation.

Spiegeleisen.—Before the outbreak of hostilities in Europe the Pittsburgh price of spiegeleisen with 20 per cent manganese content fluctuated within rather narrow limits. After 1915 it showed a marked tendency to increase and to exhibit wide variations. The following table shows the annual average price for standard-grade spiegeleisen (20 per cent manganese content) for the years 1910 to 1915, and the same averages for the years 1916 to 1919 and first six months of 1920, with the highest and lowest monthly averages for each of these years. The standard grade of spiegeleisen for the years 1918 to 1920 was that with a manganese content of 16 to 20 per cent. These prices are given in Table No. 6.

TABLE No. 6.—*Quoted prices of spiegeleisen at Pittsburgh, 1910–1920.*[1]

Years.	Grade (per cent manganese content).	Annual average (per gross ton).	Highest monthly average (per gross ton).	Lowest monthly average (per gross ton).
1910	20	$25.34		
1911	20	23.34		
1912	20	22.80		
1913	20	25.51		
1914	20	25.00		
1915	20	25.24		
1916	20	52.41	$72.50	$40.00
1917	20	72.46	82.50	65.00
1918	16–20	75.00	75.00	75.00
1919	16–20	45.78	68.75	34.00
1920	16–20	67.72	83.44	45.00

[1] From Annual Statistical Reports of the American Iron and Steel Institute and Iron Age. The quotations for 1918 to 1920 are taken from Chemical and Metallurgical Engineering.

The stability of prices in 1918 was due to the price-fixing policy entered upon under Government supervision after September, 1917, and continued till the end of 1918. It will be observed that the annual average prices of spiegeleisen from 1916 to 1920 were from two to three times those of the years 1910 to 1915.

Ferromanganese, American prices.—Ferromanganese prices increased in a similar but more striking manner during the war period. Prior to 1914 the price of standard ferromanganese at Baltimore and Philadelphia ranged from about $35 to $65 per gross ton. Since 1915 it has ranged from $110 to $400 per gross ton. The price movement with the monthly ranges are shown in Table No. 7.

TABLE No. 7.—*Prices of ferromanganese at Philadelphia and Baltimore, 1910–1920.*

Years.	Grade (per cent manganese content).	Annual average (per gross ton).	Highest monthly average (per gross ton).	Lowest monthly average (per gross ton).
1910	80	$40.49	$44.25	$36.00
1911	80	37.28	39.50	34.00
1912[1]	80	50.40	65.00	41.00
1913[1]	80	57.87	65.00	47.00
1914[1]	80	55.80	[2] 111.00	37.50
1915[1]	80	92.21	107.50	68.00
1916[1]	80	164.12	175.00	115.40
1917[3]	80	309.17	400.00	175.00
1918[4]	70	250.00	250.00	250.00
1919[3]	70–80	137.24	230.00	110.00
1920[3]	70–80	188.00	225.00	137.00

[1] Contract prices. [2] Spot price. [3] Delivered. [4] Spot and contract.

The actual prices charged by manufacturers in the East follow pretty closely those quoted in the leading trade publications. Figures furnished the Tariff Commission by two of the prominent producers and dealers in ferromanganese whose plants are located in the eastern part of the country were averaged from the years 1913 to 1919, inclusive. In Table No. 8 these averages are compared with those for the quoted prices of the corresponding years.

TABLE No. 8.—*Annual averages of prices received by leading producers from sale of ferromanganese compared with corresponding averages of quoted prices, 1913–1919.*

Year.	Average of quoted prices (per gross ton).	Average of sales prices [1] (per gross ton).	Year.	Average of quoted prices (per gross ton).	Avrage of sales prices [1] (per gross ton).
1913	$57.87	$57.87	1917	$309.17	$313.96
1914	55.80	55.53	1918	250.00	247.92
1915	92.21	96.89	1919	137.24	139.78
1916	164.12	160.22			

[1] The sales prices are simple arithmetical averages; i. e., averages of the prices at which sales were made, irrespective of the amounts sold at the different price levels. Most of the sales made are for the products delivered.

It will be observed that the domestic prices of ferromanganese reached their climax in the year 1917. Prices during 1918 were kept down by price regulation, which began in the iron and steel industry in the fall of 1917. When prices reached their maximum ferromanganese sold at six to eight times the prices prevailing during the two or three years immediately preceding the war. Even in 1919, when the manufacture of ferromanganese suffered a severe depression, the annual average was two to three times what it was in 1913 and 1914.

British and American prices compared.—British prices show a fluctuation somewhat different from that of American prices, although the same general trend is noticeable. In the prewar period British prices for high-grade ferromanganese were generally lower than those quoted by American producers. The English product was shipped in large amounts to the Atlantic seaboard of the United States, and American quotations at Pittsburgh and Chicago were those for the imported alloy plus the rail haul from Philadelphia and Baltimore.

Early in the war British prices began to rise, and almost coincidentally, American prices, the latter showing the effect of war conditions earlier than did most American prices. From 1915 to 1919 the home prices of standard ferromanganese in England were kept artificially low by the price-regulating policy of the Government, but export prices rose until in 1918 they averaged between two and three times those prevailing at home.[20] Prior to the war export prices had been quoted lower than home prices. Early in 1919 they began to fall, and before the close of the year they had reached the level of the home prices. Early in 1920 prices, both home and export, were again rising, and reached high levels in the spring and summer of that year, the export prices rising higher again than home prices.

In Table No. 9 the annual average prices of British ferromanganese, standard grade, with the highest and lowest monthly averages, are given for the period from 1913 to 1920, inclusive, in British and American currency (at the normal rate of exchange). The prices for the years 1913 to 1917 are quoted at Liverpool, and those for 1918, 1919, and 1920 for the Sheffield Steel Works.[21]

[20] It should be remembered in this connection that exports were regulated by a rebate system which kept the ferromanganese needed at home from going out of the country.

[21] The quotations are those of the Iron and Coal Trades Review (London).

TABLE NO. 9.—*Annual averages of British home and export prices of ferromanganese, with highest and lowest monthly averages, for years 1913 to 1919, inclusive.*

[Per gross ton, Liverpool, 1913–1917, and Sheffield Steel Works, 1918 and 1919.]

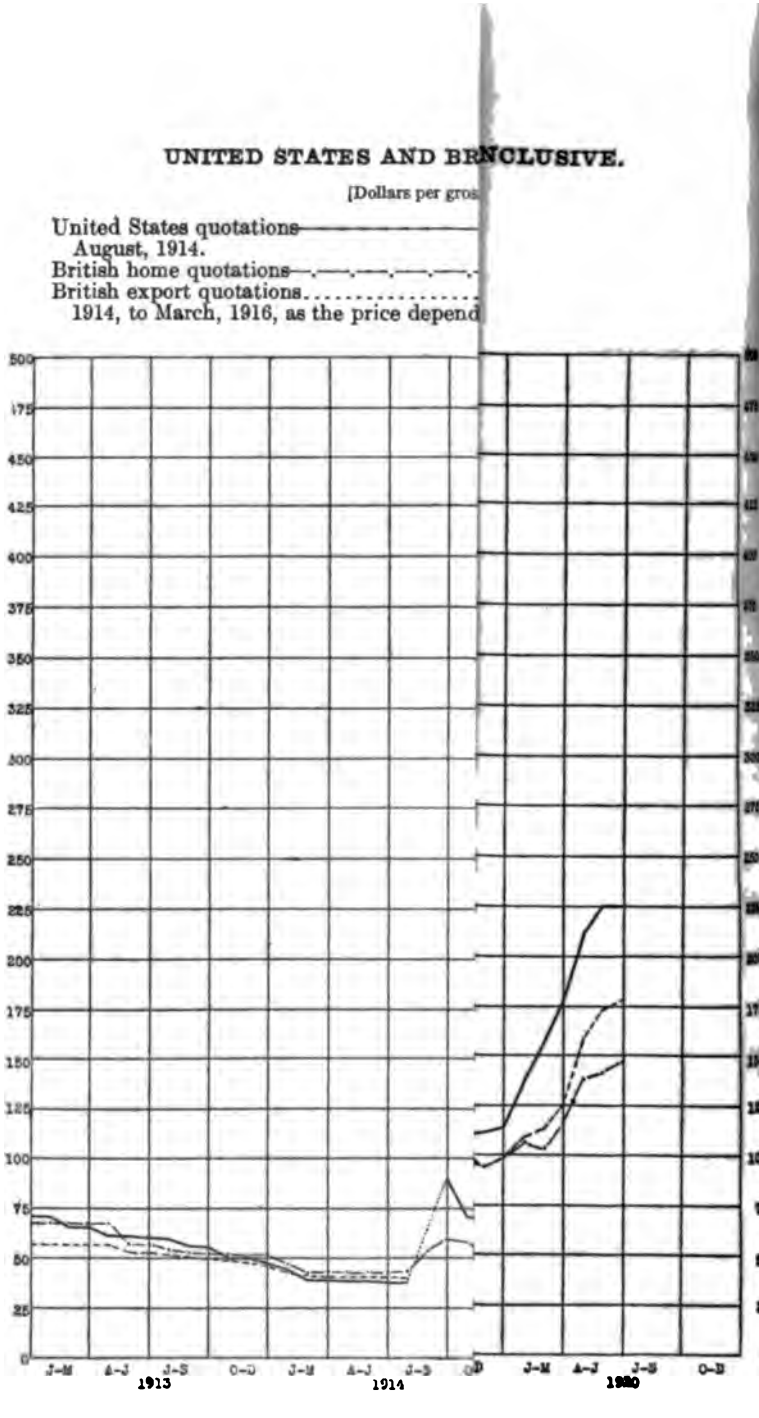
	British currency.						American currency at normal rate of exchange.	
	Home.			Export.			Home.	Export.
	£	s.	d.	£	s.	d.		
1913:								
Annual	11	17	7	10	14	9	$57.75	$52.21
Highest	13	15	0	11	10	0	66.86	55.93
Lowest	10	10	0	9	10	0	51.07	46.29
1914:								
Annual	9	19	4	[1] 8	8	4	48.44	40.94
Highest	12	5	0	[1] 8	19	6	59.60	43.61
Lowest	9	0	0	[1] 8	5	0	43.80	40.13
1915:								
Annual	17	11	4		([2])		85.47	([2])
Highest	20	0	0		([2])		97.33	([2])
Lowest	11	0	6		([2])		53.65	([2])
1916:								
Annual	24	9	8	[3] 34	11	11	119.12	168.33
Highest	25	0	0	[3] 35	14	0	121.66	173.69
Lowest	20	0	0	[3] 33	2	6	97.33	161.19
1917:								
Annual	25	0	0	57	7	6	121.66	279.20
Highest	25	0	0	80	0	0	121.66	389.33
Lowest	25	0	0	34	0	0	121.66	165.46
1918:								
Annual	26	7	6	57	1	8	128.37	277.89
Highest	26	10	0	60	0	0	128.98	291.99
Lowest	25	0	0	50	0	0	121.66	243.33
1919:								
Annual	25	1	2	[4] 30	7	2.4	121.92	147.70
Highest	26	10	0	[4] 52	0	0	128.98	253.06
Lowest	23	0	0	[4] 23	0	0	111.93	111.93
1920:								
Annual	34	14	11	40	12	6	169.09	197.79
Highest	37	0	0	45	0	0	180.06	218.99
Lowest	28	1	6	28	17	6	136.63	140.52

[1] Figures are those for 7 months. After July, 1914, export prices depended upon destination in 1914.
[2] Prices vary with destination in case of exports in 1915.
[3] Export prices for last 9 months of 1916. During first 3 months they varied with destination.
[4] Export prices for the first 10 months of 1919.

It should be noted in connection with the above quotations that the standard grade of ferromanganese suffered deterioration in England as in the United States. Nominally quotations are for the 80 per cent grade all through the war, but in practice the standard was lower. In 1919 and 1920 the standard, as in the United States, has been the alloy with a manganese content of 76 to 80 per cent. In the spring of 1920, when prices were again rising, it was claimed that the quotations for the British product were considerably lower than the prices at actual sales.

Table No. 10 is a comparison of American prices with British home and export prices in American currency at the current rate of exchange for the years 1913 to 1920, inclusive.[22]

[22] For the years 1913 and 1914 the American equivalents are given at the normal rate of exchange. From 1915 to 1920 the current rates of exchange are the basis for the American equivalents.



British prices since 1915 are on the basis of

TABLE No. 10.—*British and American prices of ferromanganese compared, 1913–1919.*

[Per gross ton.]

	British prices at current rates of exchange.		American prices.
	Home.	Export.	
1913:			
Annual average	$57.75	$52.21	$57.87
Highest	66.86	55.93	65.00
Lowest	51.07	46.20	47.00
1914:			
Annual average	48.44	40.44	55.80
Highest	59.60	43.61	111.00
Lowest	43.80	40.13	37.50
1915:			
Annual average	86.43	(1)	92.21
Highest	95.71	(1)	107.50
Lowest	53.51	(1)	68.00
1916:			
Annual average	116.50	164.55	164.12
Highest	119.19	169.82	175.00
Lowest	95.60	153.32	115.40
1917:			
Annual average	118.89	274.95	309.17
Highest	118.96	380.24	400.00
Lowest	118.80	161.79	175.00
1918:			
Annual average	120.00	260.71	250.00
Highest	126.06	285.47	250.00
Lowest	112.87	236.12	250.00
1919:			
Annual average	94.09	102.36	137.24
Highest	111.44	195.00	230.00
Lowest	87.75	83.49	110.00
1920:			
Annual average	127.68	149.45	188.00
Highest	146.15	177.75	225.00
Lowest	103.80	109.15	137.50

[1] See note 2, p. 58.

British export prices were appreciably lower in 1913 and 1914 than American prices. Home prices were nearly the same as the latter in 1913, but noticeably lower in 1914. Price regulation during the war kept the British home prices far below those prevailing in the United States, but English export prices were higher in 1916 than the American quotations. At the normal rate of exchange they were also higher in 1918 [2] and 1919; but owing to the reduced rate of foreign exchange, the pound sterling having gone below $3.20, the British prices were actually lower than those prevailing in the United States in the latter of these two years.

During the year 1920, British home prices at the normal rate of exchange were considerably below those quoted for the United States, and the export prices slightly less. During this period the pound sterling was quoted in American currency below $4, making the differences between the averages of the two countries much more than this, the actual price situation in the two countries being indicated in Table No. 10.

IMPORTS AND EXPORTS.

The imports of spiegeleisen have been small and sporadic since 1912. In no year since 1912 has the ratio of imports to domestic output been as high as 5 per cent. Practically no spiegeleisen is

[2] It should be remembered that in 1918 the quoted price in the United States was lower than it probably would have been but for the price-fixing policy which prevailed.

exported. The imports for consumption with tariff rates and duties collected for the years 1910 to 1919, inclusive, are shown in the following table:

TABLE No. 11.—*Imports of spiegeleisen, tariff rates, and duties collected, 1910–1919.*

Fiscal years.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Gross tons.				*Per cent.*
1910	$4 per ton and $2.50 per ton [1].	29,123	$585,712	$72,855.51	$20.11	12.44
1911	$2.50 per ton	25,015	476,494	62,538.63	19.05	13.12
1912	do	7,841	151,239	12,602.00	19.67	12.71
1913	do	795	22,072	1,987.50	27.76	9.00
1914	$2.50 per ton and free [2]	1,903	44,034		23.14	
1915	Free	1,244	34,396		27.65	
1916	do					
1917	do					
1918	do	5,937	519,606		87.52	
1919 [3]	do	27	1,018		37.70	

[1] $4 per ton to Aug. 6, 1909, and $2.50 per ton thereafter.
[2] $2.50 per ton to Oct. 4, 1913, and free thereafter.
[3] Calendar year. No imports are published for the 6 months from July 1 to December 31, 1918. Annual figures for imports and exports are now (1920) published by calendar year instead of fiscal year by the Bureau of Foreign and Domestic Commerce.

The imports of ferromanganese are much larger. As has already been pointed out they formed about one-half the total American consumption in the years immediately preceding the war. After 1914 imports fluctuated to a considerable extent, but in general declined. In proportion to domestic output the decline was marked. In the calendar year 1913 the ratio of imports for consumption to domestic production was 107.18 per cent; in 1918 it had sunk to 8.09 per cent.[34] In 1919 the proportion of imports produced rose to 17.82 per cent. Table No. 12 gives the imports for consumption of ferromanganese with the revenue received and rates of duty for the fiscal years 1910 to 1918, inclusive, and for the calendar year 1919.

TABLE No. 12.—*Imports of ferromanganese, rates of duty, and revenue collected, 1910–1919.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Grosstons.*				*Per cent.*
1910	$4 per ton: *a*	9,803	$385,450	$39,215	$39.32	10.17
	$2.50 per ton *b*	97,987	3,690,087	244,967	37.66	6.64
1911	do	105,528	4,047,595	263,820	38.36	6.52
1912	do	76,081	2,821,935	190,202	37.09	6.74
1913	do	128,136	5,484,829	320,341	42.80	5.84
1914	do *c*	28,567	1,258,440	71,417	44.05	5.68
1914	Free *d*	64,919	2,640,543		40.67	
1915	do	66,837	3,386,584		50.67	
1916	do	82,604	6,610,145		80.02	
1917	do	69,109	8,040,039		116.35	
1918	do	34,217	5,332,573		155.84	
1918 *e*	do	8,694	1,455,238		165.08	
Calendar years: *f*						
1919	do	33,022	4,283,541		129.72	

a From July 1 to Aug. 5, 1909, inclusive.
b From Aug. 6, 1909, to June 30, 1910, inclusive.
c From July 1 to Oct. 3, 1913, inclusive.
d From Oct. 4, 1913, to June 30, 1914, inclusive.
e From July 1 to Dec. 31, inclusive.
f Annual figures for imports and exports are now (1920) published by calendar year instead of fiscal year as heretofore.

[34] See p. 50, table 5.

Nearly all the ferromanganese imported into the United States comes from England. Prior to 1917, in the published figures of the Bureau of Foreign and Domestic Commerce, the imports of ferromanganese by countries were included with those of pig iron. The high value, however, of the pig iron imported from England indicates that probably the greater part of this product consisted of ferromanganese.

The imports by countries for the years 1917 to 1919 are shown in Table No. 13:

TABLE NO. 13.—*Imports of ferromanganese, by countries, 1917–1919.*

Years[1] and countries.	Quantity.	Value.	Years[1] and countries.	Quantity.	Value.
1917.	*Tons.*		1918 (6 months)—Con.		
England	72,426	$8,539,910	Japan	6	$1,244
British India	1,313	190,649	Total for 6 months	8,694	1,455,238
Total	73,741	8,730,559	1919.		
1918.			Scotland	39	6,484
Scotland	250	38,932	England	32,402	4,215,939
England	32,937	4,944,294	Canada	551	59,146
Japan	72	14,259	Cuba	30	1,972
Total	33,259	4,997,485	Total	33,022	4,283,541
1918 (6 months).					
England	8,688	1,453,994			

[1] The figures for 1917 and 1918 are for fiscal years and for 1919 for calendar year. The six months from July 1 to Dec. 31, 1918, inclusive, not included in the fiscal year 1918, are given separately.

Practically all the imported ferromanganese is the blast-furnace product. The ferromanganese imported from Canada, in 1919, however, was the electric-furnace alloy.

Ferromanganese is used in steel manufacture and hence moves for the most part to the important steel works in the eastern part of the country. Of the imported product the bulk enters the country through the customs districts of Philadelphia and Baltimore. Comparatively little enters through ports on the Pacific coast, although some Japanese ferromanganese has entered the country through San Francisco. Some of the alloy landed at New Orleans goes by rail to the Pacific coast. The imports by customs districts for the calendar years 1918 and 1919 are shown in Table No. 14.

TABLE NO. 14.—*Imports of ferromanganese by customs districts, 1918 and 1919.*

Customs districts.	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
Maryland	11,066	$1,778,832	10,468	$1,300,397
Massachusetts	800	130,092	50	5,256
New York	1,597	324,414	2,660	526,010
Philadelphia	8,876	1,391,762	18,060	2,274,390
Virginia	957	123,527	.....	.....
New Orleans	3,866	508,874	1,233	118,342
San Francisco	6	1,244	.....	.....
Buffalo	.....	.....	344	39,635
Michigan	.....	.....	207	19,511
Total	27,168	4,258,745	33,022	4,283,541

Import restrictions.—On December 15, 1917, the War Trade B through the Bureau of Imports, made arrangements with the A ican Iron and Steel Institute whereby this organization would a the consignee of all manganese and ferromanganese to be releas the importer, who had been granted an import license upor giving by the latter of such guaranty or agreement as the Trade Board might require.[25] Beginning with February 1, 191 Bureau of Imports issued all import licenses subject to the prov "Provided the bill of lading is indorsed to the American Iron Steel Institute." On May 18, 1918, the Bureau of Imports authorized to issue licenses for the importation from Great Brit ferromanganese and spiegeleisen not to exceed 12,000 tons.[26] January 15, 1919, licenses were issued for the importation of manganese from Great Britain covering shipments which had contracted for by American consumers prior to April 6, 1917.[27] January 20, 1919, the American Iron and Steel Institute disconti the control of distribution of imports of manganese ore, ferro ganese and spiegeleisen, although import licenses continued for a to be required.[28]

Exports.—Some ferromanganese is exported, but the amou small. Until the fiscal year 1918 they were not separately publ by the Bureau of Foreign and Domestic Commerce. That year amounted to 4,935 tons, valued at $1,054,548. Of that am 3,799 tons, valued at $900,107, went to Canada. The figures fo calendar years 1918 and 1919 with principal countries of destin are given in Table No. 15, as follows:

TABLE NO. 15.—*Exports of ferromanganese, 1918 and 1919.*

Countries.	1918 (calendar year).		1919 (calendar	
	Quantity.	Value.	Quantity.	V
	Tons.		*Tons.*	
Italy	200	$50,058	2,605	
England	134	44,313		
Canada	3,172	690,819	53	
Mexico			114	
Argentina	30	9,000	165	
All other	41	11,897	62	
Total	3,577	806,087	2,999	

These exports form but a small fraction of the domestic output. 1918 they amounted to 1.70 per cent of the home production, a 1919 to 1.62 per cent.

COMPETITIVE CONDITIONS.

Foreign competition with iron-manganese alloys produced in country is almost entirely confined to ferromanganese and c principally from England. Spiegeleisen is imported only sporadi and in small amounts. This country is well supplied with the n sary raw material and has the equipment essential to manufact

[25] Ruling No. 19, Bureau of Imports.
[26] Ruling No. 138, Bureau of Imports.
[27] Ruling No. 431, Bureau of Imports.
[28] Ruling No. 437, Bureau of Imports.

this product. Furthermore, as its bulk is large in proportion to its value, the cost of transportation is a considerable item in its selling value when shipped any great distance.

As has already been noted, ferromanganese was imported from England in large amounts prior to the war. It is still imported in considerable quantity. As the value of standard-grade ferromanganese is much higher in proportion to bulk than that of spiegeleisen, the cost of transportation forms a smaller percentage of its selling value. This alloy is therefore more likely to move in international trade as differences in costs of manufacture develop in various countries.

Cost data were secured from leading producers of both spiegeleisen and ferromanganese in order to determine with some degree of accuracy the relative importance of the several items that enter into the expense of manufacture, as well as to obtain information concerning actual costs. The figures secured covered the year ending September 30, 1919, and embraced a large proportion of the country's output. In the case of ferromanganese separate data were obtained for the blast furnace and the electric furnace products. In all cases the returns from the several manufacturing companies were averaged on the basis of the amounts produced.

In the following table are given the furnace costs per gross ton of producing spiegeleisen as averaged for four manufacturing companies producing 35,389 gross tons.

TABLE No. 16.—*Average furnace costs per gross ton of spiegeleisen for year ending September, 1919.*

Item.	Amount produced and average cost per gross ton.	Per cent of total cost.
Gross tons produced	35,389	
Raw material	$25.34	41.7
Fuel	18.62	30.7
Labor	3.77	6.2
Supplies and tools	.86	1.4
Repairs and maintenance	3.75	6.2
Manufacturing overhead	8.37	13.8
Total furnace cost	60.71	100.0

It will be observed that raw material constitutes the largest item and the fuel expense the next largest. Labor cost is only 6.2 per cent of the total. Of the raw material costing $25.34, manganese and manganiferous ores amounted to $22.57, or over 89 per cent of the raw-material cost.

The raw-material item forms a larger percentage in the total cost of ferromanganese than in that of spiegeleisen, and this is a matter of some significance in determining the competitive strength of the position of the American producer. When ferromanganese is produced in the electric furnace the cost of electric power is an important item. Labor, also, is relatively more important than in the case of the blast-furnace product.

Table No. 17 contains the average costs in blast furnaces of producing standard ferromanganese (70 to 80 per cent manganese) for eight companies whose output for the year covered by the cost figures amounted to 83,375 gross tons.

TABLE NO. 17.—*Average furnace costs per gross ton of producing standard-grade ferromanganese (70 to 80 per cent manganese) in blast furnaces during the year ending Sept. 30, 1919.*

Item.	Amount produced and average cost per gross ton.	Per cent of total cost.
Gross tons produced	83,375	.....
Raw material	$116.05	72.7
Fuel	22.05	13.8
Labor	6.13	3.8
Supplies and tools	1.50	.9
Repairs and maintenance	6.02	3.8
Manufacturing overhead	7.92	5.0
Total cost	159.67	100.0

Of the raw-material item, $113.15 gross per ton, or 97.2 per cent, consisted of manganese ore. In other words about 70 per cent of the total manufacturing cost of blast-furnace ferromanganese is included in the price paid for manganese ore.

The total cost per ton of producing electric-furnace ferromanganese is much higher due to the smaller output per furnace and the high cost of power. The average costs of the electric-furnace product, standard grade, the output of five companies, consisting of 6,279 gross tons, are shown in the following table.

TABLE NO. 18.—*Average furnace costs per gross ton of producing standard-grade ferromanganese (70 to 80 per cent manganese) in electric furnaces during the year ending Sept. 30, 1919.*

Item.	Amount produced and average cost per gross ton.	Per cent of total cost.
Gross tons produced	6,279	.....
Raw material	$118.38	54.1
Power	29.67	13.6
Labor	17.84	8.1
Supplies and tools	1.56	.7
Electrodes	13.96	6.4
Repairs and maintenance	11.11	5.1
Manufacturing overhead	25.83	11.8
Other	.59	.2
Total	218.94	100.0

The raw-material item in the cost of manufacturing the electric-furnace product averaged slightly higher than in the expense of producing the blast-furnace product, due to the fact that more domestic ores were apparently used and the plants more remotely located

from the principal ports at which foreign ores are landed. Of the raw-material cost, that of manganese ore was $106.25, or a little less than half the total cost. The manufacturing overhead item is much larger than in the case of the blast-furnace product, due to the smaller production per plant.

The cost of producing ferromanganese by the electric furnace is too high to be profitable unless prices are high. At present the electric-furnace product seems unlikely to take the place of the blast-furnace alloy. The competitive situation may therefore be considered with reference to the blast-furnace product.

The two most important items in the cost of producing ferromanganese are manganese ore and fuel. The raw material constitutes, according to the figures tabulated above, 72.7 per cent of the total cost. About 70 per cent of the total is the expense incurred in securing manganese ore. The fuel expense constitutes 13.8 per cent of the total cost and about one-half the conversion cost. Direct labor [20] forms less than 4 per cent of the total manufacturing expense.

Great Britain is the only serious competitor which the United States has in the manufacture of ferromanganese. British costs are difficult to obtain, and hence only rough estimates can be made. In the matter of blast-furnace equipment and practice England, if anything, is behind the United States. The furnaces average less in size than those of this country and have a somewhat smaller output. The coke consumption per ton of alloy produced seems to average slightly more.[20]

As the price of coke in England has ranged higher than in the United States [21] and the amount of coke per ton of ferro produced averages more, the fuel expense is greater in the former country than in the latter. The direct labor cost, which is a small item in the total expense, probably does not differ materially in the two countries, as the higher wages in the United States are largely offset by the greater daily output.

The relative cost of manganese ore in the two countries mentioned is a crucial factor in the competitive situation. Prior to the war manganese ore sold for less in England than in the United States. As already noted, a very large part of this ore was shipped from India to England in ballast and was obtainable in the latter country at 8d. to 9d. per unit (22.4 pounds).[22] The prewar freight rate on Indian ore shipped to England was about 5s. ($1.22) per ton, as against $4.32 per ton when shipped to the United States. For the British producer manganese ore from India was cheap compared with what the American producer was obliged to pay. In the United States the product rarely sold as low as 25 cents per unit.[23]

[20] It must be remembered that in speaking of labor cost only direct furnace labor is included. The labor involved in mining the ore and transporting it is embraced under the head of raw material or ore costs, that involved in repairs and maintenance of equipment, under that head, etc.

[20] The weekly output of British furnaces ranges from 420 to 520 tons per week, and the coke consumption per ton produced from 5,040 to 6,160 pounds. In the case of American furnaces the output per week runs from 20 to 50 per cent more and the coke consumption from 4,400 to 5,600 pounds per ton of ferro produced.

[21] Furnace coke in the United States in the fall of 1919 was selling at $4 and $5 per net ton. The price in England was about 40 to 50 shillings, or about double the prices in this country. Normally, however, the difference is not so great, but of late the English price has been higher than that prevailing in this country.

[22] The unit is 1 per cent of the ton. In the case of a gross ton the unit is 22.4 pounds; and in case of the short ton, 20 pounds.

[23] Brazilian ore sold as low as 21 cents per unit, and Cuban ore as low as 18 cents per unit. The manganese content of these ores, however, is lower than that of the ores from India.

It has been asserted that the practice of shipping manganese ores from India to England in ballast is now (1920) discontinued. It is also claimed that freights from India to the eastern seaboard of the United States are practically as favorable as to London. These statements are denied by American producers. According to one large manufacturer in this country, shipment in ballast from India to England still continues. Another American producer reported that he was getting his Indian ore at a freight rate of 85 shillings per gross ton when British producers were getting theirs at 70 shillings per ton.

Figures were secured concerning the average present (1920) freight rates on manganese ores to the United States and England. These rates were as follows:

	To England.			To Atlantic seaboard of United States.
	In British currency.	In American currency at the normal rate of exchange.	In American currency at current rate of exchange (£=$3.50).	
From India	£3 to £4	$14.60 to $19.47	$10.50 to $14.00	$15
From Black Sea	3	14.60	10.50	8
From Brazil				8-12

It will be observed that at the current rate of exchange the ocean freight on manganese ores from India is appreciably lower to England than to the Atlantic seaboard of the United States. The rate on ore from the Black Sea region to this country is more favorable than to England. No rates were reported on Brazilian ores to England, although such ores were being shipped to that country in 1920. The rate from Brazil to the United States has averaged somewhat less than on Indian ore to England. The cost of mining this ore, however, and shipping it from the interior to the seaport in Brazil plus export tax [36] more than makes up the difference in any advantages which this country may have over England in the matter of ocean freight rates.

The cost of converting the ore and other raw materials into ferromanganese does not differ very greatly in the two countries.[37] The ore cost being approximately 70 per cent of the total, a comparatively slight variation in freights may alter the competitive position of producers in the two countries.

Another factor which works to some extent in favor of the British manufacturer is his nearness to ports. The ore does not have to go far inland and hence the rail haul from seaboard to furnace does not add much to the ore cost. In the United States, on the other hand, the principal furnaces are farther inland, and the rail haul is something of an item in the ore cost.

The advantages of the British producers over the American in the manufacture of ferromanganese are entirely confined to items entering into the cost of manganese ore. English manufacturers have had a longer experience in producing this ferroalloy, but this factor to-day

[36] Export taxes on manganese ores from Brazil are levied by the provincial and not the federal government.
[37] In a rough tabulation of costs made by a representative of the commission who visited England late in 1919, the conversion cost did not differ very much from the cost data received from companies in this country.

is not important, as the leading American producers now make as good a product as the British and at a conversion cost approximately as low. The advantages of British producers so far as Indian ore is concerned may be summarized as follows:

1. Lower freight rates from India to England than from India to the United States.
2. Well-established trade routes for the delivery of manganese ore.
3. Closeness of British furnaces to the coast.

As has already been pointed out, very little Caucasian ore is used to-day either in England or the United States on account of the interruption of trade in that region of the world. With the reestablishment of trade, however, this high-grade ore will again be shipped to western Europe and the United States. As already indicated, the ocean freight on this ore is less to the Atlantic seaboard of the United States than to England, but geographical conditions combined with the reestablishment of old trade routes between England and the Black Sea may change this situation very materially.

Brazilian manganese ores, on the other hand, are transported to the United States at least as cheaply as to England. But comparatively little Brazilian ore has been used in Great Britain, although at the present time (1920) a considerable amount is reported as being shipped to that country. The difference in ocean freight rates between Indian ore shipped to England and Brazilian ore transported to the United States has not been great, but apparently has favored the American producer of ferromanganese. In 1914 the ocean freight from Brazil to the Atlantic seaboard of the United States was $2.88 per gross ton. In 1920 the rate, as already noted, was $8 to $12 per ton.

Other costs in the aggregate, however, would make the Brazilian ore higher in price to the American manufacturer of ferromanganese than the Indian ore to the English producer. The mining cost of Indian ore in the latter part of 1918 ranged from $0.32 to $0.97 per gross ton, while that of Brazilian ore ranged from $4 to $5 per gross ton. Transportation from mines to shipping ports ranged from $4.28 to $6.85 per gross ton in the case of Indian ore and from $2.10 to $8.15 in the case of Brazilian ore.[38]

Except during the war or at times of extraordinarily high prices, domestic ores have not been utilized to any very large extent by manufacturers of ferromanganese in the eastern part of the United States. The best ores are located in the West, remote from the great steel-producing centers of the coast. High-grade ores, as has been noted, are limited in amount and scattered over considerable areas. The silica content of American ores also tends to be high. These considerations, taken in connection with high mining costs,[39] preclude the present possibility of the domestic ores taking the place of foreign ores during normal times in the blast furnaces near the Atlantic seaboard. During periods of high prices they are likely to be utilized in the electric furnaces of Montana and the Pacific coast. For blast-

[38] Information concerning manganese ore, by U. S. Tariff Commission,.

[39] The average mining cost of manganese ore in the latter part of 1918 was estimated to be $19.53 per gross ton. With an average freight rate to furnaces in the West and South plus war taxes, etc., the cost of domestic manganese ore at electric furnaces would be $23 per gross ton. See W. R. Crane; U. S. Bureau of Mines; Cost of Manganese Production in the United States.

furnace operation, however, domestic ores at the present stage of technical progress are too costly.

The advantage enjoyed by the British producer of ferromanganese over the American in the matter of ore costs is further shown in the relative prices prevailing in England and the United States. At the beginning of 1920 the price of good grade manganese ores with 48 to 50 per cent metallic manganese content was quoted at $0.80 to $0.85 per unit, delivered, Baltimore and New York.[40] In England at the same time the price was approximately 3s. 2d. per unit. At the normal rate of exchange the British price would be equivalent to approximately $0.77 per unit, or from $0.03 to $0.08 per unit less than at the Atlantic seaboard of the United States. Owing to the greatly reduced rate of exchange on the pound sterling the difference would be much greater. The exchange rate was falling rapidly early in 1920, reaching $3.18 in February. Taking $3.70, however, as the exchange value of the pound sterling about the middle of January, the English price of manganese ore was approximately $0.60 per unit against $0.80 to $0.85 per unit in the United States.

It will be observed that the difference between British and American prices is greater than can be accounted for by the variation in freight rates on ores shipped to the countries mentioned from India and Brazil. At the normal rate of foreign exchange the prices of $0.77 per unit in England and $0.80 to $0.85 per unit at the Atlantic seaboard of the United States would correspond roughly to the difference between the two countries in the matter of transportation and mining costs on imported manganese ore. The difference between $0.77, the English price in terms of American currency at the normal rate of exchange, and $0.60, the same at the rate of exchange about the middle of January, 1920, corresponds pretty closely to the amount of depreciation which the pound sterling had suffered up to that time. In other words, Indian manganese ore was being purchased by the English ferromanganese producers with depreciated money, while the American manufacturer was obliged to pay gold or its equivalent.

Summing up the competitive situation between American and foreign producers of iron-manganese alloys the following deductions may be drawn:

1. With respect to spiegeleisen there is practically no foreign competition. The United States is abundantly supplied with low-grade manganese ores which can be cheaply utilized in the production of this alloy. The conversion cost is also low on account of the abundance and relatively low price of coke and large output per unit of labor employed.

2. Spiegeleisen being low-priced in proportion to bulk, the cost of transportation is an important element in its price when shipped long distances.

3. With respect to ferromanganese made in blast furnaces, the American producer is at no disadvantage compared with his foreign (British) competitor in converting the raw material into alloy. Fuel cost, which constitutes about half the total conversion expense, is less here than in the United Kingdom, and labor and other costs little, if any, more. The higher wages prevailing in the United

[40] Engineering and Mining Journal, June 12, 1920, p. 1340.

States are largely, if not entirely, offset by larger furnaces and greater output per man employed.

4. The price of manganese ore in the United States constitutes about 70 per cent of the cost of making blast-furnace ferromanganese. High-grade ores cost the American manufacturer more than they do the English manufacturer. This higher cost is due more particularly to four conditions: (*a*) High-grade domestic manganese ores are relatively scarce, expensive to mine, and generally located in regions remote from the steel-producing centers of the country; (*b*) ocean freight rates on Indian ores are appreciably less to England than to the United States, though not less than on the lower-grade Brazilian ores shipped to this country; (*c*) the mining cost of Brazilian ore is greater than the corresponding cost of Indian ore, tending to keep the price of Brazilian ore high; and (*d*) American blast furnaces on the average are located further from the seacoast than are British furnaces, and thus to the higher ocean freights are to be added the higher rates for the rail haul from port of entry to furnaces.

5. Electric-furnace ferromanganese, at the present stage of technical progress, costs considerably more than the blast furnace product. It forms but a small fraction of the country's output, and is not an important factor in the competitive situation.

TARIFF CONSIDERATIONS.

Five considerations are involved in dealing with the tariff aspects of the iron-manganese alloy industries: (*a*) Classification of these ferro-alloys; (*b*) the competitive situation; (*c*) the relative newness and importance of this branch of manufacture in the United States; (*d*) the possible revenue to be derived by the imposition of duties on the foreign-made product; and (*e*) compensatory duties.

(*a*) Spiegeleisen and ferromanganese have been classified in all our tariff laws from 1890 to 1913, inclusive, with "iron in pigs." This classification is unfortunate. While these ferro-alloys are blast-furnace products, they have different uses from ordinary pig iron and are valued according to their manganese and not their iron contents. The problems which arise with reference to competitive conditions and foreign trade concern the manganese and not the iron content in these alloys and their importance in steel manufacture as cleansing and alloying agents. In so far as they are listed with other products, they belong more properly as a matter of classification to the general group of ferro-alloys.

(*b*) No question now arises with reference to the competitive position of the American producer of spiegeleisen. His raw material is abundant and his conversion cost relatively low.

The situation with reference to the domestic manufacturer of ferromanganese is different. American ferromanganese is quoted at higher prices than British ferromanganese. The American cost of production is also higher. This greater cost is not due to a higher conversion cost but to the higher prices which the domestic manufacturer is obliged to pay for his ore. The cost of manganese ore to the American producer constitutes about 70 per cent of the total expense. The higher cost of this ore at American furnaces is due in a measure to the greater ocean freights from India to this country as compared with the rates from India to England, to the high

mining costs of Brazilian ores and, to a less extent, to the longer rail haul in the United States from seaboard to furnace.

(*c*) While the manufacturer of spiegeleisen and ferromanganese is not a new industry in the United States, the war gave it a great impetus and led to the establishment of several new plants. The country's output in 1918 was nearly three times what it was in 1913 and more than three times what it was in 1914. Coupled with this remarkable growth is the fact that the iron-manganese alloys are absolutely essential in steel manufacture.

(*d*) While little spiegeleisen is imported, a considerable amount of ferromanganese has been and seems likely to continue to be imported. In the fiscal year 1913, with a duty of $2.50 per ton, the revenue derived from the importation of ferromanganese amounted to $320,341. A similar duty on the much smaller importation for the calendar year 1919 would have yielded $82,555.

(*e*) The consideration of compensatory duties arises in connection with tariff rates on manganese ore and manganese steel. At present (1920) manganese ores, like spiegeleisen and ferromanganese, are admitted free, and hence there is no present problem with reference to the imposition of a compensatory duty on these alloys or on the steel made with their use. Assuming duties on both ore and alloy the following observations may be made:

It has been noted that in the manufacture of ferromanganese in blast furnaces about 20 per cent of the manganese in the ore is lost on the average. Very rarely does the recovery go above 85 per cent, and when poor ore is used it will sink below 75 per cent. Taking 80 per cent recovery (20 per cent loss) as a good average when high-grade ores are used and practice is efficient, a specific rate on manganese ore would logically require a compensatory one on ferromanganese equivalent to 125 per cent that on the raw material.

In the manufacture of common carbon steel the addition of manganese is so small that the question of compensatory duties would not arise. In the case of manganese steel a proper compensatory rate would be important. In open-hearth furnaces, when manganese steel is manufactured, the manganese recovery from ferromanganese is approximately 70 to 75 per cent in good practice, and in electric furnaces about 80 per cent. Most manganese steel in this country is manufactured in open-hearth furnaces, although the tendency is toward the use of the electric furnace. Taking 75 per cent as a good average, manganese steel would require a compensatory duty equivalent to 133⅓ per cent that on the alloy.[4]

[4] While manganese steel is only 12 to 15 per cent manganese, it is the manganese content that constitutes almost its entire value.

FERROSILICON.

DESCRIPTION.

Ferrosilicon, siliconeisen, or high silicon pig, is an alloy of iron and silicon. The silicon content ranges from 7 or 8 per cent to over 90 per cent. This ferro-alloy may be divided according to silicon content and methods of production into two general classes—the blast-furnace product, with a silicon content of 7 to 15 per cent, and the electric-furnace product, with a silicon content over 15 per cent. All ferrosilicon containing over 15 per cent silicon is made in electric furnaces, and some containing 15 per cent and less. The manufacture of the lower grades of this ferro-alloy, especially where the silicon content is 12 per cent or less, is cheaper when the blast-furnace method is used than when the electric-furnace method is employed. On account of the great heat required the production of the grades above 15 per cent is not feasible in blast furnaces.

Ferrosilicon made in blast furnaces is often called Bessemer ferrosilicon and averages in silicon content about 12 per cent. A typical analysis of this kind of ferrosilicon is as follows:

Typical analysis of blast-furnace ferrosilicon.

	Per cent.
Silicon	12.74
Phosphorus	.095
Manganese	.87
Sulphur	.02
Carbon	1.7

A blast-furnace product which is often confused with Bessemer ferrosilicon, although it should be distinguished from it, is silvery iron. The silicon content of silvery iron averages lower than that of ordinary Bessemer ferrosilicon, the range of percentage being from about 5 to 10, and the phosphorus content above the Bessemer limit (0.1 per cent). Silvery iron, as its name indicates, has a silvery fracture. It should be classified with pig iron and not ferrosilicon.

Ferrosilicon made only in electric furnaces has a silicon content ranging from 16 to over 90 per cent, with a corresponding great range in value. Various classifications of this electric-furnace product have been suggested. One given by the United States Bureau of Mines is a fourfold classification with an analysis of a typical example of each class.[1] This classification is based upon silicon content, and the groups are divided according to the most common ranges in silicon percentages found in each.

[1] Bureau of Mines, Bulletin No. 77, p. 172.

Classes and typical analyses of ferrosilicon made in electric furnaces.

	Silicon content.			
	25 to 30 per cent.	45 to 50 per cent.	75 to 80 per cent.	90 to 93 per cent.
Silicon	30.50	49.50	78.00	88.50
Iron	68.00	49.00	20.00	9.30
Manganese	.35	.30	.25	.15
Aluminum	.10	.15	.10	.15
Magnesium	.10	.15	.30	.30
Carbon	.35	.30	.30	.25
Sulphur	.02	.015	.015	.015
Phosphorus	.04	.03	.03	.03

As shown in the above analyses, the silicon percentages in two cases are slightly outside of the ranges for their classes. These ranges, however, are not hard and fast, but include alloys beyond the limits given. One producer has suggested another classification for the electric-furnace product, as follows:

Ferrosilicon—silicon content, 8 to 30 per cent.
Ferrosilicon—silicon content, 30 to 60 per cent.
Ferrosilicon—silicon content, 60 to 90 per cent.
Ferrosilicon—silicon content, 90 to 100 per cent.

Standard grade ferrosilicon is the one with a silicon content of 50 per cent, and the greater part of the electric-furnace alloy approximates this percentage.

Uses.—Ferrosilicon is used in the manufacture of iron and steel to remove dissolved oxygen and to increase the silicon content of the steel. The first function has been its principal one, but the second is of growing importance. Silicon is about four times as active as manganese in reducing blowholes and producing sound steel. It is the common practice to use manganese first for the bulk of the deoxidation and the silicon afterwards to finish the reaction.

The uses of the high and low grade varieties are similar, but in the manufacture of high-grade castings, where purity and uniformity of metal are very essential, the electric furnace ferrosilicon—generally the 50 per cent product—is used. Iron foundries are large consumers of Bessemer ferrosilicon, and steel foundries, of the electric furnace product.

Ferrosilicon will not enter into the composition of steel until the steel has been cleaned; hence when silicon begins to be added to the steel it is known that the latter has been purified. About 10 pounds to a ton for cleaning and for a slight addition of silicon to the steel are now commonly used. Ordinary steel contains from 0.1 to 0.3 per cent silicon, but special steels may contain a much larger percentage.

During the war ferrosilicon was produced for steel plants making shrapnel bars. The addition of silicon to steel beyond a certain point makes it brittle. Shells made of such steel tend to break up into small pieces in exploding.

There is a considerable demand for silicon steel from electrical companies. In making transformers for electrical work steel with a silicon content of 3 or 4 per cent is used. Another use is in the production of hydrogen.

RAW MATERIAL.

The raw materials used in the manufacture of ferrosilicon are high-grade silica (silica rock or quartz), which furnishes the silicon, iron ore or high-grade scrap steel (steel turnings or punchings), which supplies the iron content, and coal or coke, which is used as fuel in the manufacture of blast furnace ferrosilicon, and as a reducing agent when the electric-furnace process is employed. The proportionate amounts of these materials used in the production of blast-furnace ferrosilicon, as given by Gin, are as follows: Turnings, 1,000 parts; quartz, 410 parts; coke, 940 parts.

In the electric furnace the percentage of quartz or silica rock used would be much greater—increasing as the grade rises. The proportionate amounts of turnings and coke would be less.

The coal or coke and iron ore or turnings are of domestic origin. The material furnishing the silicon, silica rock or quartz, is abundant the world over. There is considerable silica (silica rock) imported from Canada owing to the proximity of furnaces at Niagara Falls and water transportation and to the reputed superiority of the Canadian material for the manufacture of the higher grades of ferrosilicon.

EQUIPMENT AND METHOD OF PRODUCTION.

Bessemer or low-grade ferrosilicon (silicon content 8 to 15 per cent) is usually made in blast furnaces which are similar to those employed in the manufacture of pig iron. Some of this ferrosilicon, especially the 12 to 15 per cent grades, is produced in electric furnaces.

The electric furnace is employed in the manufacture of all grades having a silicon content above 15 per cent.

Where the blast furnace is used there is a great wear and tear on the furnace lining due to the great heat necessary to produce the alloy. This necessitates heavy expense for relining the furnace. As the grade of the alloy rises the cost of the repairs needed mounts upward with great rapidity. The coke consumption is also large and increases with the grade of alloy manufactured.

The electric furnace when used in the manufacture of ferrosilicon is kept in constant operation, and the material is continually being fed to it. The tapping is done as seldom as possible. The ferrosilicon is dumped to cool and broken into pieces with hammers and weights. As pure materials are used, comparatively little slag is formed.

Where the electric furnace is used power consumption is an important item of expense. The amount depends upon the charge, the furnace, and the grade of product made. The consumption is much greater when iron ore is used in place of iron or steel scrap, and increases rapidly as the grade of ferrosilicon rises.

GEOGRAPHICAL DISTRIBUTION AND ORGANIZATION.

The manufacture of ferrosilicon in blast furnaces is well established in the United States. Blast furnaces for the manufacture of ferrosilicon exist in the steel-producing regions of the eastern part of the country, particularly Ohio, Pennsylvania, and Illinois. According

to the Federal census for 1914, out of a total production of 122. tons, 65,778 tons were manufactured in Ohio.[2]

The plants manufacturing the electric-furnace product tend locate where power is cheap. The largest three or four producers at Niagara Falls, where the power supplied is hydroelectric, and general, cheaper than in any other part of the country. Other c panies producing electric-furnace ferrosilicon have plants at Ba more, Md.; Chattanooga, Tenn.; Anniston, Ala.; Keokuk, Io Rumford, Me.; and Plattsburg, N. Y. On the Pacific coast, wh important power developments are anticipated in the near futu certain ferro-alloy manufacturers expect to become producers ferrosilicon.

Most of the producers of this ferroalloy, both by the blast-furn and electric-furnace methods, are concerns with moderate capi The blast-furnace production shows no marked tendency toward c tralization of control. In view of the fact that electric-furnace ope tors are entering into the field of the manufacture of low grade fe silicon, highly competitive conditions seem likely to continue. large proportion of the electric-furnace ferrosilicon manufactured the United States is made by one company. This proportion, h ever, is far from sufficient by itself to establish monopoly cont After the United States entered the war certain manufacturers paper at Niagara Falls began to produce ferrosilicon in order to ret the use of their hydroelectric power, ferrosilicon having the pre ence over paper as a war necessity. The output of these paper c panies, while considerable, has not been large.

DOMESTIC PRODUCTION AND CONSUMPTION.

As has already been pointed out, the published figures for the co try's output of ferrosilicon are unsatisfactory, partly on account incompleteness and partly because of the different grades, or at le the two general classes of blast-furnace and electric-furnace fe silicon not being differentiated. From a tariff standpoint the la defect is the more serious, as the method of production is an import factor in determining the competitive strength of domestic produc To group together all grades of ferrosilicon in published statistic output is more confusing than to lump together spiegeleisen and fe manganese, which for the most part are manufactured by the sa process.

According to figures published by the American Iron and S Institute, and by the Bureau of Foreign and Domestic Commerce, production and consumption in recent years of all grades of ferrosili may be roughly indicated as follows:

[2] Census of Manufactures, 1914: Iron and Steel, p. 21.

TABLE No. 19.—*Production and consumption of ferrosilicon in the United States, 1912–1919.*

Year.[1]	Production.	Add imports.	Subtract exports.	Approximate domestic consumption.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*
1912	104,017	5,111	.....	109,128
1913	105,715	9,257	.....	114,972
1914	136,514	5,574	.....	142,088
1915	131,617	6,509	.....	138,126
1916	234,360	5,471	.....	239,831
1917	242,462	8,715	.....	251,177
1918	297,940	5,419	8,599	294,760
1919 (6 months)	.....	4,330	2,357	.....
1919	181,751	10,445	1,544	190,652

[1] The figures for output are given by calendar year and those for imports and exports for 1912–1918 by fiscal year. This difference is due to the way in which figures for output and for annual imports and exports have been published. Roughly speaking, they indicate the relationship between domestic production and exports and imports. The figures for 1919 are all for the calendar year.

With the exception of the year 1918, consumption exceeded production, but not by large amounts. During the years above tabulated consumption never exceeded production by as much as 10 per cent. The figures, however, are in a way misleading, as the imports are almost entirely the electric-furnace ferrosilicon. On the other hand, the exports are largely the blast-furnace product.

Of the 1919 output 52,946 tons, or approximately 30 per cent of the country's total, consisted of the electric-furnace product. The ratio of imports for consumption to total production that year was about 3.3 per cent, but about 11.5 per cent of the electric-furnace output. In 1918, out of a total of 297,940 gross tons 120,483 tons consisted of the electric-furnace product.

Taking these figures into consideration it will be seen that the country's consumption of the blast-furnace product is approximately equal to the production. The consumption of electric-furnace ferrosilicon, however, is considerably in excess of the domestic output. The domestic capacity is regarded as adequate for the needs of the United States.

FOREIGN PRODUCTION.

No adequate statistics are available concerning the output of ferrosilicon in foreign countries. Ferrosilicon is produced in Canada, France, Germany, Switzerland, Austria, Norway, and Sweden.[3] The output of England in 1918 amounted to about 23,100 gross tons, all of which was of low grade. England imports the high-grade ferrosilicon which her steel producers use largely from Canada and Scandinavia.

Most of the ferrosilicon imported into the United States is produced in Canada. The annual output of that country has been variously estimated. There are only two large producers in Canada, one at Welland, Ontario, and the other at Shawinigan Falls, Quebec. The capacity of the former is about 120 tons per day of 50 per cent ferrosilicon, or about 42,200 tons per year, and is reputed to exceed that of any other plant of its kind in America. The annual capacity of the latter is about 6,000 tons.

[3] Bureau of Mines Bulletin, No. 77, p. 155.

One feature in connection with the Canadian situation is the relatively small consumption of ferrosilicon. While the productive capacity of the Canadian plants is upward of 50,000 tons per annum, the country's yearly consumption is only about 3,000 or 4,000 tons. The prosperity of the Canadian manufacturers, therefore, depends upon their export trade.

Sweden has been an exporter of ferrosilicon, and before the war a considerable amount came to the United States. With the general reduction of westbound ocean freight rates more imports from Europe, especially Norway and Sweden, may be anticipated.

PRICES.

The selling price of ferrosilicon is quoted by the gross ton, and is based entirely upon its silicon content, the greater this content the higher the price. The standard grade of Bessemer ferrosilicon is an alloy with a silicon content of 12 per cent, and the standard for the electric-furnace product is one with a silicon content of 50 per cent.

Quotations in the United States are usually published for Pittsburgh. Unlike the quotations for ferromanganese, those for electric-furnace ferrosilicon in 1917 and 1918 diverge materially from prices furnished the Tariff Commission by producers and consumers. During the war period quotations were much higher than the prices received by some of the leading producers. Table No. 20 contains the quoted annual averages for the 12 and 50 per cent grades of ferrosilicon, with the highest and lowest monthly averages in each case, for the years 1910 to 1920,[1] inclusive.

TABLE No. 20.—*Quoted prices per gross ton of ferrosilicon with 12 and 50 per cent silicon content, Pittsburgh, Pa., 1910–1920.*

Year.	12 per cent ferrosilicon.			50 per cent ferrosilicon.		
	Annual average.	Highest monthly average.	Lowest monthly average.	Annual average.	Highest monthly average.	Lowest monthly average.
1910	$25.39	$25.90	$25.00	$58.55	$62.25	$54.85
1911	24.67	25.00	23.00	58.46	69.50	51.75
1912	22.83	26.00	22.00	71.80	75.00	70.00
1913	25.18	26.00	23.75	74.96	75.00	74.50
1914	21.37	22.65	21.00	73.00	73.00	72.00
1915	21.42	29.20	18.90	75.00	85.00	73.00
1916	33.94	43.00	30.00	88.61	100.00	85.00
1917	74.58	100.00	43.00	197.71	293.75	118.93
1918	62.10	63.90	61.60	161.02	176.21	137.50
1919	46.11–60.00	50.00–66.00	45.00–60.00	99.17–111.33	148.00–152.00	85.00–95.00
1920	56.50–63.90	60.00–65.00	45.00–60.00	81.00–90.00	85.00–85.00	80.00–84.00

The prices secured from manufacturers of the 50 per cent grade vary materially from the quotations above given. In the prewar years they correspond pretty closely to those tabulated, but from 1914 to 1919, inclusive, they are much lower. In no case was a price of

[1] Quotations for the years 1910 to 1918, inclusive, are from the Iron Age, and those for 1919 and 1920 from Chemical and Metallurgical Engineering. The prices for the 12 per cent grade are f. o. b. works; for the 50 per cent grade, delivered, from 1910 to 1918, inclusive; and f. o. b. works, for the years 1919 and 1920. The figures for 1919 and 1920 are contract prices. The Bessemer ferrosilicon for 1919 and 1920 are for grades 10 to 15 per cent silicon content.

$293.75 per ton given by any producer of 50 per cent ferrosilicon for 1917. The average annual selling prices of 50 per cent ferrosilicon received by one of the largest producers in this country compared with the quoted averages for the years 1913–1920 are as follows:

[Per gross ton.]

Year.	Selling price of 1 company.	Quoted prices.
[illegible]	$73.02	$74.9[illegible]
[illegible]	68.77	73.00
[illegible]	65.32	75.00
[illegible]	79.30	88.61
[illegible]	93.07	197.71
[illegible]	136.53	161.02
1919	124.10	99.17–114.33
1920 (January–June)	81.76	82.34–92.34

The great variation between quoted and actual selling prices, especially in the years from 1917 to 1919, inclusive, is due to the fact that the latter are for the most part based upon long-time contracts, which would naturally not reflect the extreme fluctuations of the market in periods of great changes, and would show a lag in both the upward and downward movements of price quotations.

Prices of the 75 and 90 per cent grades ranged much higher than those of the 50 per cent grade. In 1913 and 1914 the 90 per cent grade was selling at more than double the prices of standard ferrosilicon. During the war the price of this grade increased, but not to the same extent as the lower grades. After the armistice the fall in price was not so marked as in the case of the standard grade.

Bessemer ferrosilicon rose in price during the war as did other grades, particularly after the United States entered the war. A significant feature, however, of the price situation after the war is that the fall in the quotations for the Bessemer grades was much less than in the case of the standard grade. The difference may be illustrated by comparing the averages of the two alloys for the years 1912–1914 with those for 1919 and 1920, and noting the difference in percentages of the 1919 and 1920 prices, using the quotations for the years 1912 to 1914, inclusive, as a base, as follows:

Ferrosilicon prices compared.

[Price per gross ton.]

Year.	Bessemer ferrosilicon with average silicon content 12 per cent.		Electric-furnace ferrosilicon, 50 per cent silicon content.	
	Average price.	Per cent.	Average price.	Per cent.
1912–1914	$23.13	100.0	$73.25	100.0
1919	53.05	229.4	105.75	144.4
1920	60.20	260.3	85.50	116.7

It will be observed that while the Bessemer ferrosilicon prices for the years 1919 and 1920 were from 130 to 160 per cent higher than

they were in the years 1912 to 1914, inclusive, those of the electric-furnace standard grade were only about 16 to 45 per cent higher. The difference is attributable in part to the Canadian competition in the standard grade, which became very keen after the signing of the armistice, and partly to more intense domestic competition on account of the sudden curtailment of demand following the cessation of hostilities.

British prices.—English prices of ferrosilicon are significant only in relation to world market conditions. England, as already seen, produces only the Bessemer grades and exports very little. The electric-furnace product is entirely imported. A comparison of the monthly averages of British and American prices of standard-grade ferrosilicon (at the normal and current rates of exchange) is shown for the year ending in June, 1920, in the following table:

TABLE NO. 21.—*British and American prices of standard grade ferrosilicon (50 per cent silicon content) compared for year ending June 30, 1920.*

[Price per gross ton.]

	British prices.[1]				American prices.[2]
	British currency.			American currency.	
				Normal rate of exchange.	Current rate of exchange.	
1919.	£	s.	d.			
July	21	0	0	$102.20	$76.23	$87.50–$114.00
August	20	0	0	97.33	72.60	85.00– 115.00
September	21	10	0	104.63	78.05	85.00– 105.00
October	19	10	0	94.90	81.71	85.00– 95.00
November	19	0	0	92.46	77.90	85.00– 95.00
December	20	5	0	98.55	78.17	85.00– 95.00
1920						
January	20	5	0	98.55	76.55	85.00– 95.00
February	20	15	0	100.98	71.80	85.00– 95.00
March	24	0	0	116.80	87.36	84.00– 94.00
April	25	8	0	123.61	100.33	80.00– 90.00
May	25	5	0	122.88	96.96	80.00– 90.00
June	25	0	0	121.66	98.75	80.00– 90.00

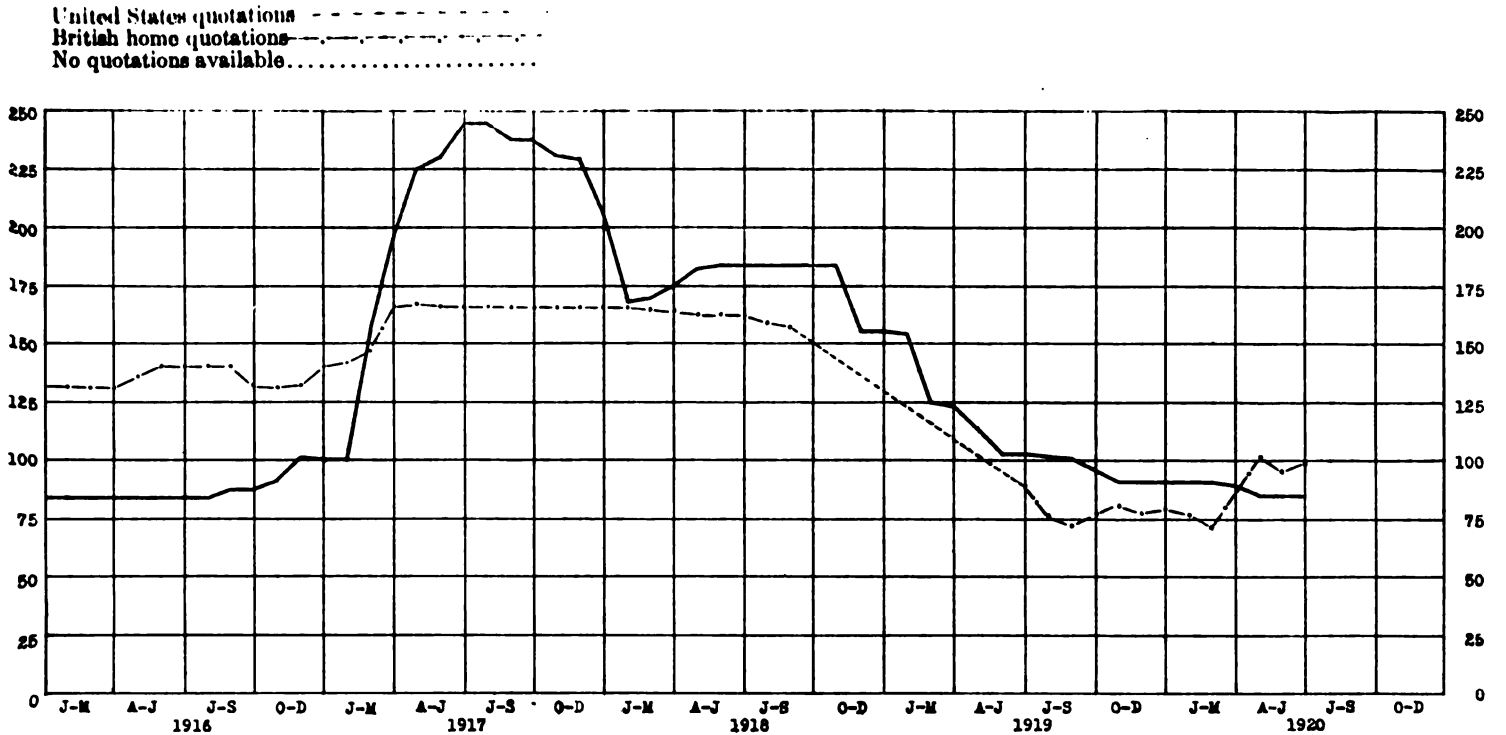
[1] Prices are net delivered Sheffield Steel Works. Quoted from Iron and Coal Trades Review (London).
[2] Prices f. o. b. works. From Chemical and Metallurgical Engineering.

Averaged for the year at the normal rate of exchange American prices are considerably lower than British prices. As the rates of exchange on the pound sterling during the period covered were much below normal the difference in prices between the two countries was not so great, as can be seen from the comparison of the British quotations at the current rates of exchange and American prices. During the last half of 1919 and the first two months of 1920 British prices were quoted in the current rates of exchange below American prices and above them from March to June, 1920, inclusive.

Canadian prices.—Only a small part of the Canadian ferrosilicon is consumed at home, and hence Canadian prices are not so significant as they would be if the home market were more important. (See below under "Imports and exports" and "Competitive conditions.")

CHART No. 2. UNITED STATES AND BRITISH PRICES OF FERROSILICON (50 PER CENT) FROM JANUARY, 1916, TO JUNE, 1920, INCLUSIVE.

[Dollars per gross ton.]



British prices since 1915 are on the basis of the current rates of exchange.

Other foreign prices.—Recent prices of ferrosilicon in continei Europe, which typify market conditions, are difficult to obtain account of the war and business disorganization resulting th from. Before the war the general situation is indicated by the ra of prices at Duisburg, Germany. On January 1, 1913, these pr f. o. b. in American currency were as follows:

	Per gros
Made in blast furnace, 10 per cent silicon	$3
Made in electric furnace, 45 per cent silicon	7
Made in electric furnace, 75 per cent silicon	12

The blast-furnace product was higher in Germany than in United States, and the electric-furnace grades a little lower. G many has recently undersold the Scandinavian makers of elect furnace ferrosilicon.

Government price fixing.—During the war the prices of blast-furn ferrosilicon were subject to regulation under Government supervisi On September 24, 1917, President Wilson, by official statement, f mally approved an agreement between the War Industries Board a steel manufacturers fixing prices on a number of products. The pri fixed for ferrosilicon were as follows:

Bessemer ferrosilicon:
For iron containing silicon—
10 per cent silicon, $22 per gross ton above base.
11 per cent silicon, $25.30 per gross ton above base.
12 per cent silicon, $28.60 per gross ton above base.

The base upon which the prices of blast-furnace ferrosilicon w fixed was No. 2 foundry, Chicago. This price was $33 per gross t Hence the price of 12 per cent ferrosilicon was $61.60 ($33 + $28. The price-fixing policy of the Government was discontinued on Ja ary 1, 1919.

IMPORTS AND EXPORTS.

Ferrosilicon, as has been shown, is imported into the United Sta in amounts smaller than the domestic production. Except during years when the tariff act of 1909 was in operation, 1910–1914 (fis years), the figures for imports for consumption, published by Bureau of Foreign and Domestic Commerce, do not distingu between the blast-furnace and electric-furnace classes. The re tively high value of the imported product, as well as the princi countries of origin, show that most of the imported ferrosilicor the electric furnace product. Under the act of 1909 just referred there is a difference in the rates on the two classes and the amou imported of each are tabulated. The imports for consumption w their values and duties collected for the years 1910 to 1919, inclusi are shown in the following table:

No. 22.—*Imports for consumption of ferrosilicon, rates of duty, and revenue collected, 1910–1919.*

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Gross tons.				*Per cent.*
.....	$4 per ton.....	3,717	$106,080	$14,870	$28.54	14.02
.....	$5 per ton.....	3,816	74,727	19,080	19.58	25.53
.....	20 per cent.....	6,281	360,906	72,181	54.46	20.00
.....	$5 per ton.....	1,090	22,472	5,450	20.62	24.25
.....	20 per cent.....	9,390	458,048	91,609	48.78	20.00
.....	.....do.....	5,110	282,173	56,434	55.21	20.00
.....	.....do.....	9,257	574,494	114,898	62.06	20.00
.....	.....do.....	1,779	111,416	22,283	62.63	20.00
.....	15 per cent.....	3,795	223,750	33,562	58.96	15.00
.....	.....do.....	6,509	365,526	54,828	56.16	15.00
.....	.....do.....	5,471	328,740	49,311	60.09	15.00
.....	.....do.....	8,715	580,198	87,029	66.57	15.00
.....	.....do.....	5,419	358,022	53,703	66.07	15.00
-Dec.).	.....do.....	4,330	359,227	53,884	82,96	15.00
.....	.....do.....	10,445	629,362	94,404	60.25	15.00

July 1 to Aug. 5, 1909, inclusive.
Aug. 6, 1909, to June 30, 1910, inclusive.
July 1 to Oct 3, 1913 inclusive.
[4] Oct. 4, 1913, to June 30, 1914, inclusive.
[5] Calendar year.

greater part of the imported ferrosilicon has come from Canada, gh before the outbreak of hostilities in Europe a considerable it came from Sweden and smaller amounts from other countries. ollowing table shows the distribution of imports among the ɔal contributing countries for the years 1914 to 1919, inclusive:

No. 23.—*Importation of ferrosilicon by countries, for the years 1914 to 1919, inclusive.*

ported from—	1914		Fiscal year— 1915		1916	
	Gross tons.		*Gross tons.*		*Gross tons.*	
.....	2,458	$153,291	5,615	$314,098	5,234	$303,777
.....	1,043	54,274	687	28,958		
ngdom.....			149	13,889	218	22,346
.....	155	7,402	70	3,117		
.....			50	2,731		
.....	64	3,004				
.....	30	2,599	13	1,611	17	2,490
ungary.....			24	1,037		
l.....	3,750	220,570	6,608	365,441	5,469	328,613

ed from—	Fiscal year— 1917		1918		1918 (6 months).[1]		1919 (calendar year).	
	Gross tons		*Gross tons*		*Gross tons*		*Gross tons*	
.....	8,666	$574,947	5,408	$356,240	4,330	$359,227	10,445	$629,362
.....	49	5,251						
.....			11	1,782				
l.....	8,715	580,198	5,419	358,022	4,330	359,227	10,445	629,362

[1] July 1 to Dec. 31, 1918.

Since 1915, due to war conditions, almost all the imported fe silicon has come from Canada. Attention has already been ca to the fact that while that country is a large producer of ferrosil it is a small consumer. While the prices of ferrosilicon rose rap in this country and Europe during the years 1915 to 1918 thos Canada showed only a slight change. Ferrosilicon being a necessity and the Government interested in keeping the price such necessities at moderate levels, war conditions evidently fluenced the ferrosilicon market in Canada. At the same time w a country exports the bulk of any commodity it produces and a large part of it to a country imposing an ad valorem duty on imported product based upon prices prevailing in the countr origin, it may be good business policy to sell in the home cou at an unduly low price in order to establish a basis for a tariff r The payment of duty in the country to which the commodit exported could thus be legally reduced. The artificial price co tions brought about by the war may thus be in a sense contin during peace times as a matter of business policy. There are s significant figures with reference to the value per unit of the fe silicon imported from Canada compared with that imported f other countries during the period of rapidly rising prices from 1 to 1918. These figures are shown in Table No. 24.

TABLE NO. 24.—*Importation of ferrosilicon by quantity, and value per unit in co of origin, 1914–1918.*

Year and country.	Quantity.	Value.	Av p pe
1914.	*Tons.*		
France	30	$2,599	
Germany	64	3,004	
Norway	155	7,402	
Sweden	1,043	54,274	
Canada	2,458	153,291	
Total	3,750	220,570	
1915.			
Austria-Hungary	24	1,037	
France	13	1,611	
Italy	50	2,731	
Norway	70	3,117	
Sweden	687	28,958	
England	149	13,889	
Canada	5,615	314,098	
Total	6,608	365,441	
1916.			
France	17	2,490	
England	218	22,346	
Canada	5,234	303,777	
Total	5,469	328,613	
1917.			
England	49	5,251	
Canada	8,666	574,947	
Total	8,715	580,198	
1918.			
Canada	5,408	356,240	
Japan	11	1,782	
Total	5,419	358,022	

ppears from the above that the increase in the prices of ferro- which was particularly noticeable in the United States, e, and Japan was not marked in Canada. During the years nd 1915 the valuation of ferrosilicon from Canada was above erage for the total importation, but below that average during rs 1916–1918. In 1916 it was about half the average imported rance and England, about 40 per cent below that of England 7, and about 60 per cent below that of Japan in 1918. Unfor- ly the published import figures do not show the grades from rious countries, but figures obtained from the customs dis- of Buffalo and Michigan, through which the bulk of the Cana- mports come, show that most of their product was about rd (50 per cent) grade.[5]

most of the imported ferrosilicon is produced in Canada near reat Lakes and St. Lawrence River and is consumed in the roducing region of this country, it enters the United States largely through customs districts on the great Lakes. In fiscal year) about two-thirds of the imported product entered Canada by way of Buffalo, and the bulk of the remainder h the customs district of Michigan. In 1919 (calendar year) cent came through Buffalo and 26 per cent through Michigan. exports of ferrosilicon have generally been light, altnough in ar 1918 on account of war conditions they exceeded imports. llowing table contains the exports with the countries of des- n for the fiscal year 1918, the last six months of 1918, and the ar year of 1919:

No. 25.—*Exports of ferrosilicon by countries for fiscal year 1918, the second half of 1918, and calendar year 1919.*

Destination.	1918 (fiscal year).		1918 (July 1-Dec. 31).		1919 (calendar year).	
	Gross tons.		*Gross tons.*		*Gross tons.*	
	400	$44,791	200	$20,220	5	$1,000
ds	10	832				
	188	9,881				
Europe	2,538	251,089				
	691	82,560	455	84,014	156	28,220
	878	49,213	576	32,157	420	20,876
	4	423	53	3,417		
	7	590	1	250	32	4,214
	3,222	419,704	1,070	104,953	694	73,034
	216	9,112				
	100	17,131			5	997
and	330	29,000				
est Africa	15	3,360				
					144	7,146
					64	7,331
ongo			1	223		
			1	162	2	182
Africa					22	2,310
al	8,599	917,686	2,357	245,396	1,544	145,310

rther evidence of this practice of artificial undervaluation see under Competitive Conditions.

COMPETITIVE CONDITIONS.

Competitive conditions with reference to the manufacture of ferrosilicon vary with the process employed. In the case of blast-furnace ferrosilicon raw materials, including fuel, constitute nearly 65 per cent of the total cost. These materials, however, are abundant and cheap in this country. The labor item is not large, and the expense involved in the equipment and maintenance of blast furnaces are greater than in the case of similar furnaces devoted to the production of pig iron, but competitive conditions here and abroad are not essentially different in this particular.

The cost of producing ferrosilicon in electric furnaces depends to a considerable extent upon the price of electric power, the expense of the latter increasing as the silicon content in the alloy becomes larger. The labor item is also greater in the case of the electric-furnace product, due mainly to the smaller output per man employed. Raw material is a large item, as in the case of the blast-furnace ferrosilicon. Raw material is abundant and cheap in the United States while power costs are higher than in some countries.

Figures concerning the cost of producing the principal grades of ferrosilicon were secured by the commission from leading manufacturers of the United States for the year closing September 30, 1919. These costs have been averaged in the same way as those of spiegeleisen and ferromanganese in order to determine the relative importance of the principal items entering into the total expense of manufacture.

The costs of blast-furnace ferrosilicon are itemized from figures furnished by five companies whose output for the year covered amounted to 61,738 gross tons, as follows:

TABLE NO. 26.—*Cost of producing ferrosilicon (8 to 15 per cent silicon) in blast furnaces during year ending Sept. 30, 1919.*

Items.	Cost per gross ton of ferrosilicon produced, and amount of output.	Per cent of total.
Raw material	$11.78	28.0
Fuel	15.47	36.8
Labor	4.53	10.8
Supplies and tools	1.29	3.0
Repairs and maintenance	.93	2.2
Manufacturing overhead	8.07	19.2
Total	42.07	100.0
Amount produced.....gross tons..	61,738	.....

It will be observed that the largest single item is fuel which amounted to over 35 per cent of the total cost. Raw material constituted 28 per cent of the total, and labor about 10 per cent. The manufacturing overhead averaged 19.2 per cent, but varied greatly among the different companies, the largest producer having an unduly high percentage for this item. Ordinarily this item would be much

r, but after the armistice in November, 1918, there was a great the output of some companies which for the time being did not general overhead charges to any material extent. In addition profit was apparently included.

costs of electric-furnace ferrosilicon were much higher, even e low-grade product. The following table is an itemized ent of the averages for electric-furnace ferrosilicon with a content ranging from 8 to 25 per cent. These costs were ed by three companies whose total output for the year men- amounted to 4,360 gross tons.

No. 27.—*Cost of producing electric-furnace ferrosilicon (8-25 per cent silicon content) for the year ending Sept. 30, 1919.*

Items.	Cost per gross ton of ferro-silicon produced, and amount of output.	Per cent of total.
erial	$20.04	37.5
	15.25	28.5
	7.46	14.0
nd tools	1.30	2.4
	3.58	6.7
nd maintenance	1.68	3.1
uring overhead	4.18	7.8
al	53.49	100.0
roduced gross tons	4,360	.....

cost of the electric-furnace product (8 to 25 per cent silicon) bout 25 per cent greater than that of the blast-furnace alloy. g allowance for the tonnage of higher-grade material included output covered by these costs, i. e. grades containing 16 to 25 nt silicon but not included in the blast-furnace figures, the dif- was still marked. The raw material constituted between 35 per cent of the total. The cost of silica was but a small per- e of the raw-material expense, the big item being iron and steel or iron ore. The power cost was the next largest item, being r cent of the total. Labor constituted 14 per cent of the total. costs of the higher grades of ferrosilicon were much greater hose already considered, and the relative importance of the l items was also altered in some notable respects. Table No. tains a statement of the average costs of six companies making 50 per cent ferrosilicon and a similar statement of three com- manufacturing the 70 to 75 per cent grades. The former ent covers an output of 50,718 gross tons and the latter a tion of 886 gross tons.

TABLE NO. 28.—*Cost of producing electric-furnace ferrosilicon, 50 to 60 and 70 to 7[illegible] per cent grades, for the year ending Sept. 30, 1919.*

Items.	50 to 60 per cent grades.		70 to 75 per cent grades.	
	Cost per gross ton of ferrosilicon produced and amount of output.	Per cent of total.	Cost per gross ton of ferrosilicon produced and amount of output.	Per cent of total.
Raw material	$28.14	29.5	$27.07	14.0
Power	25.05	26.2	73.51	37.9
Labor	16.73	17.5	38.25	19.7
Supplies and tools	2.18	2.3	2.72	1.4
Electrodes	4.79	5.0	28.51	14.7
Repairs and maintenance	6.83	7.2	12.78	6.6
Manufacturing overhead	11.82	12.3	10.92	5.7
Total	95.54	100.0	193.76	100.0
Amount produced.....gross tons..	50,718	.....	886	.....

In the 50 to 60 per cent grades over 55 per cent of the total cost was raw material and power. The raw material was nearly 30 per cent and power over 25 per cent of the total. The cost of power per ton of ferrosilicon produced advanced in the case of the 50 to 60 per cent grades nearly $10 over that of the 8 to 25 per cent grades. The raw material cost advanced about $8 per ton and labor about $9. If the raw material item were divided into silica rock, coke, and iron and steel turnings, the last would constitute about 10 per cent of the total cost.

In the manufacture of the 70 to 75 per cent grades the cost of electric power per ton of alloy manufactured was nearly trebled compared with that of the 50 to 60 per cent grades and labor more than doubled. The cost of electrodes, which was 5 per cent or less of the total in the lower grades, became nearly 15 per cent of the total in the 70 to 75 per cent grades. The raw material cost was less important, both absolutely and relatively, largely on account of the smaller amount of iron and steel turnings required in the manufacture of high-grade ferrosilicon.[6]

As already noted, the 50 per cent grade is standard for electric-furnace ferrosilicon, and by far the largest part of this alloy made in electric furnaces belongs to this grade. The three most important items, aside from overhead, in the cost of manufacturing 50 per cent ferrosilicon are electric power, iron and steel turnings (included in Table No. 28 with raw material), and labor. With reference to the last two items, the producer in this country is handicapped to some extent in his competition with manufacturers in Canada in the higher prices he is obliged to pay for iron and steel turnings. Since the close of the war iron and steel turnings have been selling in Canada at prices ranging from $8 to $12 per ton, while on this side of the international boundary line the price has ranged from $17 to $21. On November 24, 1920, machine-shop turnings were quoted at $9 per ton at Toronto and $12 per ton at Montreal. At the same time

[6] As the silica content increases the iron content becomes less. Hence less of this material is used.

axle turnings were quoted at $17 to $18 per ton at Buffalo.[7] These quotations show approximately the relative prices of iron and steel scrap prevailing in the two countries during the last few years. One factor in this price situation is that Canada is a much larger consumer than producer of iron and steel. There is thus a considerable surplus of scrap which can not be consumed at home in steel mills. Much of this scrap represents the wastes of a great number of small producers who are not specially interested in marketing it in the United States, where higher prices could be obtained. It is therefore sold to ferrosilicon manufacturers and others. During the war, too, a considerable stock of old material was accumulated and the Canadian ferroalloy manufacturer is profiting by the sale of this material at relatively low prices.

Labor cost does not differ materially in the two countries. Wages, on the whole, are somewhat lower in Canada than in the United States, but the difference so far as electric furnace operation is concerned is not great.

The competitive situation with reference to electric power is greatly in favor of the Canadian manufacturer. It has already been observed that producers of ferrosilicon tend to locate in regions where power is comparatively cheap, and the power utilized is mainly hydroelectric. Cheap water power depends upon the combination of a relatively steady and full flow of water and high heads. In the mountain streams of this country where there are high heads the flow varies greatly with the seasons, and in the case of rivers where the flow is more steady high heads are almost absent. At Niagara Falls and in certain mountain streams of the Pacific coast the combination is found.

The potential hydroelectric power at Niagara Falls is very great. At present approximately 653,500 horsepower are developed, of which the United States has 265,000 and Canada 388,500. Under the existing (1918) treaty Canada takes 36,000 second-feet and the United States 20,000 second-feet, the water diverted to the Chicago drainage canal serving to balance the United States rights. It has been claimed that surveys indicate that considerably more power could be taken over for power purposes without detracting from the scenic beauties of the Falls.[8] It should be said, however, that public sentiment in the United States is against any considerable further diversion of the Falls to power uses. Hence the question of securing any material increase of relatively cheap water power in this region has little present practical interest.

The mountain streams of the Pacific coast constitute a great reserve of potential water power, but the remoteness of these streams renders them of little present value for the manufacture of ferrosilicon to be used in the great iron and steel centers of the country. Furthermore, the cost of power in this region, while lower than in most other parts of the United States, is still high compared with costs in some other countries.

In Canada water power is relatively abundant and cheap. Niagara Falls furnish the Canadian producer a large amount of electrical energy, notwithstanding the fact that over 100,000 horsepower is exported to

[7] Daily Metal Market, Nov. 24, 1920.

[8] One claim is that 120,000 second-feet more, equivalent to 3,000,000 horsepower, could be so used. Commerce Reports, Mar. 10, 1919, p. 1118. Such estimates, however, have to be taken with great reserve.

the United States. In addition, there has been a considerable power development at Shawinigan Falls, Quebec, with the possibility of much greater development in the near future. (See below under "General considerations—Electric power.")

In other countries where high-grade ferrosilicon is produced hydroelectric power is cheap and abundant. Norway, Sweden, and France are well supplied with water power, and electric-furnace development has gone far in these countries.

At Niagara Falls, N. Y., where the leading producers of ferrosilicon in the United States have their plants, the present (1920) cost of power for electrometallurgical work is $20 per horsepower year. For this price the consumer must use 500 kilowatts as a minimum and for a term of not less than five years. This cost is divided into "firm energy to be supplied or kept available for supply" at a price of $23 per kilowatt per annum and "compensation for loss of electric energy between the point where the same is measured, and for the agreed value of the service for the transmission of such 'electric energy' supplied or kept available for supply as firm energy between the generating station of the company and the premises of the customer" at a price of $3.80 per kilowatt per annum. The total charge is thus $26.80 per kilowatt per annum, or approximately $20 per horsepower year.

This power is supplied by the Niagara Falls Power Co., which is an amalgamation of the Hydraulic Power Co., the Niagara Falls Power Co., and the Cliff Electric Distributing Co. This amalgamation became effective November 1, 1918. The original company was known as the Niagara Falls Hydro-Electric Power & Manufacturing Co., which in 1910 split into the Hydraulic Power Co. and the Cliff Electric Distributing Co. The Hydraulic Power Co. later absorbed the Cliff Electric Distributing Co. In 1918, as already stated, the Niagara Falls Power Co., a separate organization, became amalgamated with the Hydraulic Power Co. and gave the combination its own name.

The company has three plants, two at Niagara Falls, N. Y., and another across the Niagara River in Canada. The Niagara Falls, N. Y., plants are by far the larger. The drop of water at the Falls is about 160 feet, but by diverting a part of the stream some distance above the upper rapids the company secures a head of 215 feet. The company's plant in Canada has about 100,000 horsepower.

On the Canadian side of the Falls electric power is cheaper, ranging from $10 to $18 per horsepower year in Ontario. Most of this power is sold through the Hydro-Electric Power Commission of Ontario. This commission is not a revenue-making body, but aims to furnish power at cost; i. e., at a price sufficient to cover the expense of operation, depreciation, amortization, interest on bonded debt incurred by taking over the private companies and properties, and provisions for ultimate payment of this debt. During and since the war the policy of the commission has been to keep the power on the Canadian side. American producers have also been induced by low rates to migrate to Canada.

While the power rates on the American side of the Falls is $20 per horsepower-year, some producers of ferrosilicon by virtue of old contracts pay less. Some of these rates are as low as $15 and $16

per horsepower-year, and in one instance the rate is even lower.[9] As old contracts expire the rate is raised to $20.

During the war some of the American producers of ferrosilicon at Niagara Falls were obliged to add to their allotment of power in order to supply the increased demand for this ferroalloy. As the available waterpower was already in use resort was had to steam-generated power which cost as high as $80 and $90 per horsepower-year. This high cost was, of course, a temporary condition brought on by a great world crisis, and was not excessive compared with what is paid in other parts of the country for steam-generated electrical energy. Since the war the use of steam-generated electric power has been discontinued by manufacturers of ferrosilicon.

The great bulk of the ferrosilicon manufactured in Canada is produced by one company whose plant is located at Welland, Ontario. In 1907 this company entered into a contract whereby it was to be supplied with hydroelectric power for 30 years at a cost of $12.75 per horsepower-year, or nearly 40 per cent less than the regular rate charged American ferroalloy manufacturers by the Niagara Falls Power Co. This rate is still in operation, and has 17 years yet to run. Such a rate gives a great advantage to the Canadian producer.

At Shawinigan Falls, Quebec, where the Canadian Ferro Alloy Co. was established, power rates are also lower than in the United States. The Shawinigan Water & Power Co., supplying power in that part of Canada, advertised rates of $15 and $16 per horsepower-year in 1919.

In some countries of Europe power costs for manufacturers are also lower than in the United States. In Norway an American company has a plant for the manufacture of ferrosilicon. The price paid by this concern for hydroelectric power is $7.40 per horsepower-year, the contract having been entered into in 1913. While this plant is not now operating, the company is still paying for power at this rate. In France ferroalloy producers pretty generally own their own power plants and get their hydroelectric power at a cost of about $8 to $10 per horsepower-year.

The foreign rates for hydroelectric power mentioned above compared with the charge of $20 per horsepower-year paid by American manufacturers at Niagara Falls, where the cost is less than in any other part of the United States, show that certain foreign producers have a great advantage over American manufacturers with respect to one of the most important items of cost. This advantage increases as the grades above standard are reached. As shown in Table No. 28, the item of hydroelectric power constituted about 38 per cent of the total cost in the manufacture of the 70 to 75 per cent grade.

In the manufacture of ferrosilicon the item of direct labor cost is smaller than that of power. It is also smaller than that of fuel in the case of the Bessemer grades. This item ranges from about 10 to 20 per cent of the total cost in the grades above tabulated. As already mentioned, the Canadian producer of ferrosilicon has no pronounced advantage over the American in cheaper labor cost. In European countries the lower rates of wages paid workmen would operate to the disadvantage of the American producer. Before the war the labor cost per ton of ferrosilicon (50 per cent grade) produced

[9] Some of the low rates are bound up with old mill and water rights.

in Norway and France, as estimated in a published bulletin of the Bureau of Mines,[10] was from 33 to 47 per cent less than in the United States. Owing to the disorganization of industry and the uncertain state of foreign exchange it is difficult to say whether the same relative difference in wages exists at the present time (1920). Labor cost, however, is not so important an item in the expense of manufacturing high-grade ferrosilicon as electric power and is a still less important item in the total expense of producing Bessemer ferrosilicon.

Nearly all the imported ferrosilicon comes from Canada at the present time (1920). Attention has already been called to the fact that Canada, while a large producer of ferrosilicon, is a comparatively small consumer, and that producers in such countries might find it to their advantage to sell a limited amount of this product in the home market at an artificially low price in order to evade part payment of duty in a foreign country having an ad valorem tariff rate, and then selling in such country at the regular market price or slightly below it. If such a practice is indulged in, the real tariff is something below the nominal ad valorem rate.

Efforts were made by the commission to determine whether or not ferrosilicon is imported into the United States under such conditions as would amount to a partial evasion of import duty. The prices of Canadian ferrosilicon at destination in the United States with scale for determining grade and the deductions from these prices made by importers for the levying of duty were secured for several shipments during the years 1917 and 1918. These prices with deductions made by importer are shown in Table No. 29.

TABLE NO. 29.—*Prices per gross ton f. o. b. destination, of certain lots of Canadian ferrosilicon shipped to the United States, with deductions made by importer, 1917 and 1918.*

	Price per gross ton f. o. b. destination.	Scale (over or under).[1]	Deduction made by importer per gross ton.
1917	$99.00	$1.95	$22.00
	100.00	2.00	22.00
	93.00	1.65	6.00
	91.00	1.65	14.00
	250.00	5.00	148.19
	99.00	1.95	8.85
	225.00	4.50	138.11
	99.00	1.95	9.03
1918	99.00	1.95	8.72
	99.00	1.95	9.15
	130.00	2.60	9.60
	130.00	2.60	9.42

[1] These figures indicate the amounts above or below the prices indicated because of differences in the grade of ferrosilicon shipped from those invoiced.

The prices shown in the first column were those received by the Canadian manufacturers from American consumers. These prices minus the deductions shown in the third column represent the bases on which ad valorem duties were levied. The deductions are far in excess of transportation charges and the allowances made according to the scale indicated in the second column. According to the tes-

[10] Bureau of Mines: Bulletin No. 77, 173

of a customs official there is usually a deduction of from 20 per cent from the prices in this country, the prices in Canada ch import duties are collected being so much below those pre- in this country. The result is that the ad valorem rate of cent in Canada averages about 11.25 per cent on the basis of an selling prices.

as already been shown in Table No. 24, that during the war errosilicon prices, like the prices of other commodities, rose , the value of the Canadian product imported into this y remained relatively stable. This stability was not due to ces received in this country remaining low but to the low f the product sold at home. Price-fixing policies during the fluenced this situation to some extent, but very low prices ntinued up to the present time (1920).

selling of Canadian ferrosilicon in the United States under nditions just mentioned favors the Canadian producer as certain other foreign manufacturers. French, Swedish, and European producers have marketed a small percentage of their s in this country and therefore have been guided by world- onditions. It is worthy of note that in the last two years, nd 1919, this country has received little or no ferrosilicon oreign countries other than Canada.

ould be noted in this connection that Scandinavia, especially y, is well adapted in natural resources for the manufacture silicon. Power cost is lower there than even in Canada. he restoration of the normal output of coal in England and ipment to the Scandinavian Peninsula combined with the low freights now obtainable westward across the Atlantic, compe- from this quarter is possible and probable. In Norway the tive possibilities are great but the market is limited, resem- these respects Canada.

nnection with the Canadian competition it may be noted that American producers of electric-furnace ferrosilicon have rced to abandon the production of the high grade ferro and their furnaces to the manufacture of silvery iron and the ntaining 10 to 15 per cent silicon. As already observed the cture of these products is cheaper in blast furnaces than in furnaces. Since the war, however, the price of low-grade icon has been relatively high while that of the standard cent) grade product has been comparatively low, due largely adian competition. Thus in the first half of 1920 the price er cent ferrosilicon was ranging from $53 to $63 per gross about 150 per cent above the average for the years 1912 to hile the 50 per cent grade was selling at $82 to $93 per gross only about 20 per cent above the average for the prewar nentioned. The cost of producing the low-grade material elatively less it has become more profitable to engage in the cture of low-grade ferrosilicon than in the higher grade alloy. ning up the competitive situation the following conclusions drawn:

he cost of producing Bessemer or blast furnace ferrosilicon is in the United States as anywhere else in the world. The raw l and fuel, which constitute about 65 per cent of the total

cost, are as abundant and as low in price here as elsewhere. Labo cost is only 10 per cent of the total, and, as in the case of ferroman-ganese, the higher wages in this country are offset by the large output per man employed.

2. The cost of producing electric-furnace ferrosilicon, especially the standard and higher grades, is greater in the United States than in some countries. This difference is mainly owing to the fact that in such countries as Canada, Norway, and France, water power, which is a very important item in the total cost, is cheaper than in the United States. In Canada, where we get the bulk of our imported ferrosilicon, power costs range from 10 to 50 per cent less than at Niagara Falls, N. Y., where power on any large scale is sold more cheaply than in any other part of the United States. As the grade of product rises power cost becomes more important, and hence the advantage of the country having low-price power becomes more pronounced.

3. Other cost factors like raw material and labor give the foreign producer under normal conditions but slight, if any, advantages. There is little difference between the wages of American and Canadian workmen, and while labor cost may be lower in Europe than in the United States, it is not such a big factor in the total cost as power and raw material. Coke or coal and silica rock are about as cheap here as in other countries.

4. Since the war, however, scrap iron and steel turnings have been sold in Canada at much lower prices than in this country. This condition is partly due to the fact that Canada is a large consumer of finished iron and steel, but a relatively small producer, thus having a considerable scrap surplus. The lower scrap prices materially favor the Canadian manufacturer.

5. Canada is a large producer and a relatively small consumer of ferrosilicon. During the war the home prices of the Canadian product did not exhibit anything like the rise that characterized prices in other countries. While ferrosilicon from that country sold in the United States at much higher prices than at home it apparently sold sufficiently low to drive out of the American market temporarily the ferrosilicon made in other countries. The low home price in Canada meant lower rates of duty on the Canadian product than on that from other countries.

6. While European competition has been absent during the war the reduction in ocean freights, coupled with the restoration of the normal output of coal, will favor importation from Europe, par-ticularly Scandinavia.

TARIFF CONSIDERATIONS.

The tariff problems with reference to ferrosilicon involve the following: (1) The question whether specific or ad valorem duties should be imposed; (2) arrangement of tariff rates in the event of specific rates being prescribed; (3) competitive conditions; and (4) possible revenue.

(1) The fact that the country from which nearly all the imported ferrosilicon has recently come is a large producer but a very small consumer makes possible a relatively low duty when the tariff rate is an ad valorem one based upon the market value of the product in

the country of export. The valuation of the imported alloy being thus based, specific rates are preferable to an ad valorem rate.

(2) If specific rates are adopted, recognition should be given to the great range in value of ferrosilicon due to the varying silicon content. At least four classes should be recognized: (*a*) The 8 to 30 per cent grades; (*b*) the 31 to 60 per cent grades; (*c*) the 61 to 90 per cent grades; and (*d*) all ferrosilicon having a silicon content above 90 per cent. This classification, of course, is a very broad one and can be made more minute. The important thing to observe, however, is that the imposition of specific rates calls for a graduated scale of duties because of the great variation in value of the alloy. If specific rates are imposed they might advantageously be based upon so much per pound of contained silicon.

In addition to the classes mentioned, provision should be made for silvery iron having a silicon content of 7 per cent or less. The lower grades of ferrosilicon were formerly classified with foundry iron—and are so to a considerable extent yet—because foundry iron has a larger silicon content than other kinds of pig iron. This classification, so far as silvery iron with 7 per cent or less silicon content is concerned, is legitimate, and can well be made in tariff laws. This product is not ferrosilicon but pig iron, and should be so classified.

(3) With reference to competitive conditions, there is a broad distinction between the manufacturers of Bessemer or blast furnace ferrosilicon and the producers of the electric-furnace product. The position of the former in the United States is not threatened in any way by foreign competition. The position of the latter is much less secure. The cost of electric power is a large item in the total expense of manufacturing electric-furnace ferrosilicon. This cost is considerably more in the United States, even where power is cheapest, than in Canada, France, and Norway. This relatively high cost of electric power in the United States is the principal reason why the American producer of ferrosilicon is at a disadvantage compared with foreign manufacturers, and this disadvantage is more marked in the very high grades; i. e., the grades having 60 per cent silicon content and more, than in the lower grades.

A less serious handicap is the higher cost of scrap iron and steel in the United States than in Canada. The item of iron and steel turnings is sufficiently large in the manufacture of the standard grade ferrosilicon to make this difference in price a material handicap to the American producer.

(4) The revenue derived from the importation of ferrosilicon in the calendar year 1919 was $94,404. This revenue was larger than that obtained during any other year since 1913. In the fiscal year 1913, when a 20 per cent ad valorem rate was imposed on the grades higher than 15 per cent, the duties collected amounted to $114,898. In 1911 the $5 per ton rate imposed upon the grades containing 15 per cent silicon or less and the 20 per cent ad valorem duties on the higher grades yielded the Government a revenue of $97,059. In the fiscal year 1916 the revenue derived from the importation of ferrosilicon sank to $49,311.

It is to be noted that it is for the most part the electric-furnace ferrosilicon which is imported. The relatively large revenue collected in 1913 was derived entirely from the grades having a higher silicon content than 15 per cent.

FERROCHROME.

Next to the iron-manganese alloys and ferrosilicon, ferrochrome is more largely produced in the United States than any other of the ferroalloys. Measured by the amounts produced it is the most important of the ferroalloys sold by the pound.

DESCRIPTION.

Ferrochrome, or ferrochromium, is an alloy of iron and chromium. Besides these metals it contains other elements—carbon, silicon, aluminum, manganese, calcium, sulphur, and phosphorus. It is graded per unit of chromium and per cent of carbon. It is sold on the basis of a chromium content of 60 per cent or more.

Chromium, which is the most important constituent in the alloy and is the principal determinant of its value, is not found free in nature. Its chief occurrence is as an oxide in combination with iron and other elements called chrome ore. The pure metal is hard, steel gray in color, and not readily oxidized. It alloys with iron in all proportions and is used principally as ferrochrome.

The price of ferrochrome varies with the chromium content. In ordinary classification, however, a 60 per cent or greater chromium content [1] is assumed, and the alloy is divided into groups according to carbon content. Ordinary high-carbon ferrochrome may be divided into two classes having the following percentages of carbon: (1) 4 to 6 per cent and (2) 6 to 8 per cent. Besides these two classes there is the class of low-carbon or carbon-free ferrochrome. The cost of producing the first two classes does not vary greatly, although it tends to be somewhat higher for the low than for the high carbon grades. The cost of the low-carbon or carbon-free alloy is much greater than that of the other classes because of the more expensive process used.

Typical analyses of the grades most commonly used show the following percentages of principal ingredients:

	4–6 per cent carbon.	6–8 per cent carbon.	Low carbon (less than 2 per cent).
	Per cent.	*Per cent.*	*Per cent.*
Chromium	68	67	70
Iron	24	23	27.15
Carbon	5	7.1	a.25
Silicon	1	1.25	1
Phosphorous	.03	.03	.03
Sulphur	.03	.04	.11

a Maximum 2 per cent.

[1] Steel makers usually want an alloy with a chromium content of 65 per cent or more. One complaint of steel makers against the use of California chromite is that it does not produce ferrochrome with a sufficiently high chromium content. See under "Raw materials."

These grades are made by the electric furnace or electric-furnace and silicon processes. The first grade (4–6 per cent carbon) is the kind commonly preferred by steel companies, and is used principally in armor plate and automobile steels. The second (6–8 per cent carbon) is usually sold at a lower price and is employed principally in shell manufacture or mixed with lower carbon grades.

A typical analysis of the carbon-free alloy made by the aluminum process shows the following constituents:

Chromium	60.45 per cent.
Aluminum	2 per cent.
Silicon	0.45 per cent.
Carbon	Technically free.
Iron	Balance.

The carbon-free ferrochrome, produced by the aluminum process, is made in limited amounts. There is considerable demand for the ½ to 2 per cent carbon alloy and for the 6 per cent carbon grade. The 3 and 4 per cent carbon grades are not in great demand.

Uses.—Ferrochrome is used extensively in the manufacture of steel for armor plates, armor-piercing projectiles, wire, bullet-proof steel, tool steel, high-speed steel, high-grade castings, stamp-mill shoes and dies, safe steel, tires, axles, springs, razors, file and cutlery steel, and for other purposes. Ferrochrome containing less than 2 per cent carbon is used in the manufacture of tool steels and high-speed steels, while for the manufacture of armor plate and projectiles the high-carbon ferrochromes containing 5 to 7 per cent carbon are generally used.

Ferrochrome is employed in adding chromium to steel. Chrome steels usually contain 0.25 to 3 per cent chromium and 0.2 to 1 per cent carbon.[3] The principal characteristic of such steels is their great hardness and toughness, and it is for the purpose of giving the steel in larger measure this quality that the chromium is added.

RAW MATERIAL.

The raw material out of which ferrochrome is made is chromite-chromate of iron or chrome ore. High-grade anthracite coal, coke, or charcoal is used as a reducing agent.

While there are considerable deposits of chromite in the United States, especially in California, a large part of this material is imported. In 1913 less than 1 per cent of the ore used in the manufacture of ferrochrome came from domestic sources; in 1918 nearly 50 per cent of this supply was of home origin. Since the close of the war there has been a marked return to the use of foreign ores.

The countries supplying the imported ores have been New Caledonia, Rhodesia, Portuguese Africa, Greece, Turkey (in normal times), Canada, Brazil, Cuba, and Guatemala. Of the countries named New Caledonia is the most important, both on account of the size and quality of its deposits. The ores from Guatemala are also of very high grade, but the supply is limited.

Chromite thus far discovered and utilized in this country exists in deposits of limited size, making economical mining difficult or impossible. It has been claimed, however, that larger deposits exist

[3] Bradley Stoughton: The Metallurgy of Iron and Steel, p. 399.

in regions remote from railroads in California and Oregon. Mines and quarries which were opened during the war, were, for the most part, quickly exhausted.

In addition to the high cost of domestic ores due to the small size of deposits or remoteness from railroad facilities manufacturers of ferrochrome maintain that they have not the proper percentages of ingredients to insure the economical manufacture of a high-grade alloy. One large producer says:

> In addition to the difficulty of making ferrochromium of proper carbon content from domestic ores, other disadvantages are the low chromium content of the alloy, low chromium recovery, and the low rate of production this ore yields—all being due to the low chromium and high iron contents of domestic ore. Since the ratio of chromium to carbon is of particular importance to steel manufacturers, the combination of high carbon and low chromium contents is highly undesirable, and would result in an increase of off quality heats. The low rate of production increases manufacturing costs to such an extent that a profitable business of smelting foreign ore might easily be turned to an unprofitable business with domestic ores.

Another large producer states that it is impossible to use domestic ores in the manufacture of ferrochrome with a 65 to 70 per cent chromium content, which is the grade usually requested by steel firms. Domestic ores because of the large amount of iron oxide and relatively small amount of chromium oxide give a ferrochrome containing only 58 to 62 per cent metallic chromium.

Typical analyses of certain domestic and foreign ores showed the following ingredients:

TABLE NO. 30.—*Chemical analyses of typical chrome ores, domestic and foreign.*

Component.	Source of ores.					
	Turkey.	New Caledonia.	Rhodesia.	Canada.	Guatemala.	California.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Cr_2O_3	52.3	55.0	52.03	41.64	57.2	40.92
FeO	13.5	13.3	12.61	14.46	14.0	13.89
Al_2O_3	14.5	15.6	13.04	.....	9.9	11.00
MgO	15.0	10.2	13.40	.....	15.4	21.00
SiO_2	3.0	.5	5.30	8.54	1.4	10.00
CaO	1.5	.2	.56	.....	.2	Trace.

It will be observed that in the above table Canadian and California ores have a smaller percentage of chromium oxide and a larger percentage of iron oxide in proportion to chromium than any of the others. An analysis of 40 shipments of California chrome ore to a Pacific coast plant showed a larger percentage of iron oxide than the above figures indicate and also a larger percentage of chromium oxide. This analysis is as follows:

	Per cent.
Silica	5.70
Chromium oxide	47.65
Chromium	32.74
Ferrous oxide	15.09
Iron	11.73
Aluminum	9.61
Lime	1.21
Magnesia	15.85
Manganous oxide	.87
Phosphorus	.037
Sulphur	.003
Moisture	.44
Ignition loss	1.86

From present indications the United States will have to rely upon foreign countries for the greater part of its supply of chromite in order to produce high-grade ferrochrome. When domestic ores are used they are usually mixed with material from New Caledonia, Guatemala, or other foreign sources.

METHODS OF PRODUCTION.

Ferrochrome of the more commonly used grades is produced at the present time almost exclusively in electric furnaces. Until the close of last century it was manufactured in crucible and blast furnaces. In the crucible furnace the chromite was reduced with charcoal, and a flux of lime, borax, and fluorspar or water-glass was used. In the blast furnace chromite was reduced with considerable difficulty and with great fuel consumption. About 3 tons of coal or coke were used in the blast furnace in the manufacture of 1 ton of ferrochrome.

The process of manufacturing ferrochrome in an electric furnace consists in mixing a charge of chromite and anthracite coal, coke, or charcoal in proportions based upon theoretical calculation. The ore is finely powdered. The charge is shoveled into the open top of the furnace and around the electrodes. At intervals of two to four hours the ferrochrome is tapped from the bottom into pots set on cars.

In the manufacture of ferrochromes having a carbon content of 4 to 8 per cent there is comparatively little variation in the cost of production. In alloys containing less than 2 per cent carbon, however, the cost is increased because they are subjected to an additional refining process.

Some of the carbon-free ferrochrome is manufactured by the thermit process. In this process aluminum is used. The cost is great, amounting to three or four times that of the electric furnace method.

METALLIC RECOVERY.

As in the case of the iron-manganese alloys there are metallic losses in the manufacture of ferrochrome and in the making of chrome steels. These losses are hard to estimate with any degree of precision, as much depends upon the ores used, the grade of alloy produced, the process of manufacture, and the skill of workmen. Recovery of metallic chromium is greater when New Caledonian and Rhodesian ores are used than when the domestic material is employed, greater in the case of high-carbon than in the case of low-carbon ferrochrome, greater in alloying steel in electric furnaces than in open-hearth furnaces, and greater with experienced and skillful workmen than with inexperienced individuals.

In the manufacture of ferrochrome with a carbon content ranging from 2 to 8 per cent the recovery from ore to alloy would range from 75 to 90 per cent, about 88 to 90 per cent when New Caledonian and Rhodesian ores are used, and about 75 to 80 per cent when domestic ores are employed. When the carbon content is 1 per cent recovery is much less—not over 45 per cent. When the thermit process is used in the manufacture of carbon-free ferrochrome the recovery is not far from 80 per cent.

The above are only rough averages. Figures taken from the records of certain companies show considerable variation from month to

month. The following recoveries were recorded in the manufacture of high-carbon ferrochrome by one company for certain months in the year 1919: August, 70.26 per cent; September, 76.05 per cent; October, 89.75 per cent; November, 79.66 per cent.

This company used both domestic and New Caledonian ores. The variation from month to month is great and averages below the recoveries obtained by some other concerns making the same grade.

In alloying steel in an electric furnace the recovery of chromium from ferrochrome is nearly 100 per cent. In the open-hearth process of steel manufacture the loss of metallic chromium would range from 15 to 20 per cent, although definite figures are likely to be misleading. In many cases a furnace loss may be lessened by a partial recovery. The recovery of metallic chromium from alloy to steel, when the open-hearth process is employed, averages in good practice from 80 to 85 per cent.

GEOGRAPHICAL DISTRIBUTION AND ORGANIZATION.

Plants manufacturing ferrochrome exist at Niagara Falls, N. Y., in western Pennsylvania, New Jersey, Virginia, West Virginia, Alabama, Colorado, and California. Ferrochrome in small or experimental quantities has been made in Washington, Tennessee, and other States. The greater part of the country's output is produced at Niagara Falls and West Virginia. As in the case of ferrosilicon, though to a less extent, there is a marked tendency for producers to locate where the cost of electric power is low.

Until the outbreak of the World War practically all the ferrochrome made in the United States was manufactured by one company, the Electro-Metallurgical Co. This company has plants at Niagara Falls, N. Y., Glen Ferris, W. Va., and Holcomb Rock, Va., all producing ferrochrome. While considerably over half the country's output in 1919 was manufactured by this company, seven different concerns were producing this ferroalloy that year. The carbon-free ferrochrome made by the aluminum process is produced only by the Metal & Thermit Co., whose plant is located in New Jersey.

PRODUCTION AND CONSUMPTION.

From the years 1915 to 1919, inclusive, the annual output of ferrochrome in the United States has varied from about 9,000 gross tons to nearly 25,000 gross tons. During part of this period the bulk of the output was that of one company.

During the war period the consumption of ferrochrome in the United States was about equal to its production. Very little ferrochrome was imported and practically none exported. Before the war consumption exceeded domestic production by a considerable margin. Since the signing of the armistice imports have increased greatly. Since there are practically no exports of ferrochrome from the United States the prewar excess of consumption over production has returned. Domestic capacity, however, is believed to be ample for the needs of home consumption.

FOREIGN PRODUCTION.

Figures regarding the foreign production of ferrochrome are not available. France is a large producer of this ferroalloy and much of our importation comes from that country. Ferrochrome is also manufactured in Norway, Germany, and Switzerland. Prior to the war very little was made in England, but now the English market is largely supplied by British producers. An Anglo-French company controls the Rhodesian chromite deposits. Norway is reported to have large works owned by the same interests which supply electric power to factories.

IMPORTS.

Before 1914 a considerable part of the ferrochrome used in the United States was imported. During the war imports rapidly declined, amounting to nothing in the fiscal year 1918. During the latter part of 1919 importation revivied, the total for the six months from July 1 to December 31, inclusive, amounting to 413.7 gross tons (926,616 pounds). The imports for consumption with revenue collected for the years 1910 to 1919, inclusive, are shown in the following table:

TABLE No. 31.—*Imports for consumption of ferrochrome and chromium metal and revenue, 1910–1919.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Tons.*				*Per cent.*
1910	25 per cent	172	$21,130	$5,282.00	$122.85	25
1910	20 per cent	25	22,153	4,430.00	868.75	20
1911	25 per cent	658	58,700	14,675.00	89.08	25
1911	20 per cent	47	24,583	4,916.00	522.82	20
1912	25 per cent	189	20,685	5,171.00	109.40	25
1912	20 per cent	11	14,220	2,844.00	1,292.73	20
1913	25 per cent	459	53,624	13,406.00	116.80	25
1913	20 per cent	63	35,667	7,133.00	563.55	20
1914	25 per cent	50	3,855	963.00	77.10	25
1914	20 per cent	2	1,584	316.00	792.00	20
1914	15 per cent	156	20,537	3,080.00	131.00	15
1915	do	81	6,943	1,041.00	857.00	15
1916	do	10	1,998	299.00	199.00	15
1917	do	10	1,851	277.00	185.00	15
1918	do					
Calendar year:		*Pounds.*				
1919	do	926,616	100,404	15,060.60	0.108	15

The decline in imports during the war period was pronounced. Much ferrochrome was in demand in the warring countries for the manufacture of armor plate, projectiles, and other military necessities. During 1918 and the first half of 1919 (calendar years) no ferrochrome was imported. The last six months of 1919, however, showed a phenomenal increase in the importation of this alloy.

The country contributing the greater part of the imported ferrochrome is France. During the years 1916 and 1917 the imported ferro alloy came entirely from Norway. The imports by countries for the years 1913 to 1917, inclusive, are shown in the following table. There were no imports in 1918 and those for 1919 are not separately published by countries by the Bureau of Foreign and Domestic Commerce.

TABLE NO. 32.—*Imports of ferrochrome, by countries, 1913–1917* [1] *(fiscal years).*

Imported from—	1913		1914		1915		1916		1917	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Val
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*		*Gross tons*	
France	338	$42,159	133	$10,719	74	$5,969	.....	.....	.....	.....
England	130	11,018	3	337	1	94	.....	.....	.....	.....
Germany	46	34,121	19	9,911	1	411	.....	.....	.....	.....
Netherlands	5	1,904	.....	.....	.....	.....	.....	.....	.....	.....
Switzerland	.....	.....	50	3,880	.....	.....	.....	.....	.....	.....
Norway	.....	.....	5	661	.....	.....	10	$1,998	10	$1,
Total	519	89,202	207	25,508	76	6,494	10	1,998	10	1,

[1] The figures for the years 1913 to 1917, inclusive, were furnished in a letter from the Bureau of Foreign and Domestic Commerce, dated Oct. 5, 1917.

PRICES.

As has already been pointed out ferrochrome is graded according to chromium and carbon constituents. As the chromium content rises the price of the alloy increases with each added unit, assuming a fixed carbon percentage. The price increases as the percentage of carbon diminishes, a tendency which becomes very pronounced when the carbon content falls below 2 per cent. With the same chromium content the carbon-free alloy is usually quoted about three or four times as high as the 4 to 8 per cent carbon grades.

While the increased proportion of chromium means a corresponding rise in the price of the alloy sold, the quotations are per pound of chromium contained. Prices therefor are named according to the carbon constituent—e. g., ferrochrome, per pound of chromium, 6–8 per cent carbon, $0.20.

Published quotations before the war were very fragmentary. The ordinary carbon grades, 4–8 per cent, sold in this country at about 9 or 10 cents per pound of contained chromium. During the war open-market prices rose to 45 cents per pound of chromium contained in December, 1917, and to 50 cents in the early part of 1918. During the last four months of the latter year prices ranged from 30 to 40 cents per pound. Since the armistice they have shown a pronounced tendency to decline. The following table shows the monthly averages for two of the most commonly used grades for the years 1919 and the first half of 1920.[3] The bulk of the product was sold at the prices averaged further on.

[3] Quotations taken from Chemical and Metallurgical Engineering.

No. 33.—*Prices per pound of contained chromium of ferrochrome, ½ to 2 and 4 to 8 per cent, carbon grades, January, 1919, to June, 1920, inclusive.*

	4–8 per cent carbon[1] per pound of Cr.	½–2 per cent carbon[1] per pound of Cr.
1919.		
[illegible]	$0.30 –$0.40	
[illegible]ry	.30 – .40	
[illegible]	.30 – .40	
[illegible]	.32 – .40	$0.70
[illegible]	.32 – .40	.70
[illegible]	.32 – .40	.70
[illegible]	.32 – .40	.70
[illegible]	.32 – .40	.70
[illegible]ber	.30 – .40	.70
[illegible]r	.26 – .40	.70
[illegible]ber	.25 – .40	.70
[illegible]ber	.22½ – .40	.70
1920.		
[illegible]y	.20 – .40	$0.21– [illegible]
[illegible]ry	.20 – .40	.21– .50
[illegible]	.20 – .25	.21– .23
[illegible]	.20 – .21	.21– .22
[illegible]	.20 – .21	.21– .22
[illegible]	.18 – .19	.19– .20

[1] quotations in Chemical and Metallurgical Engineering are for the 6 to 8 per cent carbon grades and [illegible]r cent grade. As a matter of fact the grades bought and sold at these prices are for those given above.

[illegible]e prices reported by various companies to the Tariff Commission [illegible]sponded on the average pretty closely with the lowest quotations [illegible]e 4 to 8 per cent carbon group. In the spring of 1920 the com[illegible]es giving their prices reported 18 and 19 cents per pound of [illegible]ained chromium as the prevailing one for the high carbon groups, [illegible]om 1 to 2 cents less than the above quotations would indicate.

[illegible]e of the large producers of this country averaged its selling [illegible]s on ferrochrome for the Tariff Commission for the years 1913–[illegible], for each quarter in 1919, and for the first half of 1920. These [illegible]s are for an alloy containing 65 to 70 per cent chromium and [illegible] 7 per cent carbon and are given as f. o. b. Pittsburgh. The [illegible]ages are as follows:

	Per pound of contained chromium.
[illegible]	$0.09
[illegible]	.0875
[illegible]	.11
[illegible]	.125
[illegible]	.15
[illegible]	.285

	Per pound of contained chromium
1919:	
First half	$0.32
Third quarter	.28
Fourth quarter	.245
1920, first half	.1925

[illegible] in the case of ferrosilicon the prices above given are for the most [illegible] contract prices, and for the years 1917 and 1918 are much below [illegible]et quotations. According to market quotations prices reached [illegible] climax early in 1918 but owing to the lag always noticeable [illegible]ntract values the highest point is here reached early in 1919.

[illegible]e prices of electric-furnace ferrochrome with a carbon content [illegible]s than 2 per cent ranged in 1920 from 40 to 70 cents per pound [illegible]ontained chromium, depending on the carbon content. The [illegible]on-free alloy made by the aluminum process was selling in the [illegible]g of 1920 at 80 cents per pound of contained chromium.

During the fall of 1920 prices were falling, the 4 to 8 per ce carbon grades being quoted in December at 16 to 18 cents per pou of contained chromium.

Until very recently price quotations in foreign countries like th in the United States were very fragmentary. On January 1, 19 the following prices for different grades of ferrochrome were tak from the quotations in Stahl und Eisen for Duisburg, Germany:[4]

Thermit process:
Carbon-free, basis 60 per cent chromium, 2,000 pounds..... $
Electric furnace:
Refined No. 1, 0.3 to 0.75 per cent carbon, basis 60 per cent chromium. 2,000 pounds.....
Refined No. 2, 1 to 2 per cent carbon, basis 60 per cent chromium, 2,000 pounds.....
4 to 6 per cent carbon, basis 60 per cent chromium, 2,000 pounds.....

Unfortunately these prices while based upon a chromium conte of 60 per cent admit of considerable variation from this base, a hence make comparisons with American prices impossible. general, however, they do not seem to differ to any very great exte from the prices prevailing at the same time in this country.

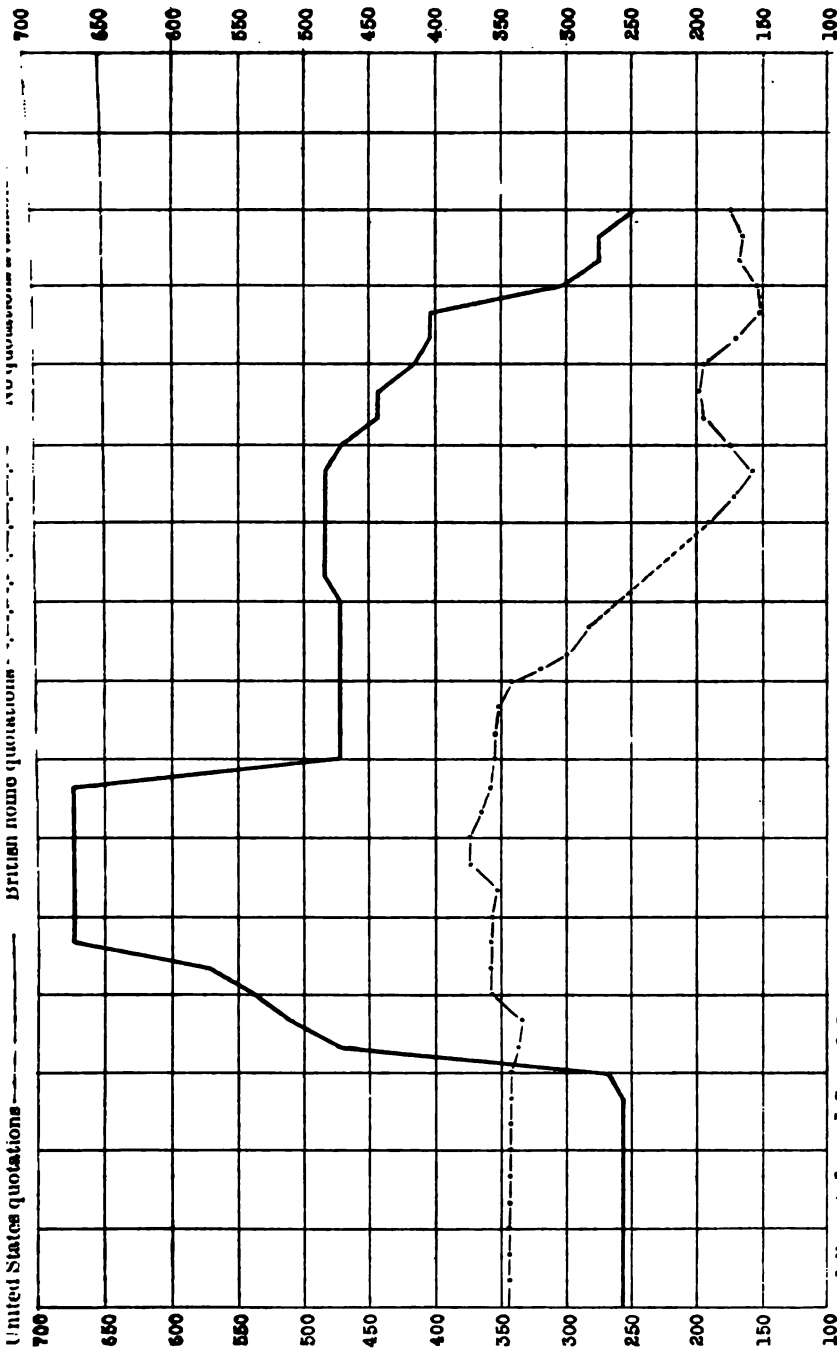
In 1919 the quoted prices of ferrochrome were considerably higl in this country than in western Europe. The tendency, howev was toward a closer approach in price levels as the year closed. Tal No. 34 contains the monthly quotations in England and the Unit States of the 6 to 8 per cent carbon grades of ferrochrome for t year ending June, 1920.[5]

TABLE No. 34.—*Prices of ferrochrome with carbon content of 6 to 8 per cent, basis 60 cent chromium, for year ending June, 1920, in England and the United States.*

	English prices (per gross ton).	English prices in United States currency (per gross ton).		American prices (pe gross ton
		Normal rate of exchange.	Current rate of exchange.	
1919.	£ s. d.			
July	47 10 0	$231.16	$172.43	$430.08–$53
August	43 8 0	211.21	157.54	430.08– 53
September	48 0 0	233.59	174.24	403.20– 53
October	46 12 0	226.78	195.25	349.44– 53
November	48 10 0	236.03	198.85	336.00– 53
December	45 0 0	218.99	173.70	302.40– 53
1920.				
January	45 0 0	218.99	170.10	268.80– 53
February	44 5 6	215.46	153.20	268.80– 53
March	42 10 0	206.83	154.70	268.80– 33
April	42 10 0	206.83	167.88	268.80– 28
May	43 0 0	209.26	165.12	268.80– 25
June	44 0 0	214.13	173.80	241.92– 26

The English prices above quoted are given in American curren at the normal and current rates of exchange. On account of t low rates of foreign exchange prevailing all through this period t current English prices were actually 20 to 30 per cent lower on t average than the prices quoted at the normal rate would indica

[4] Stahl und Eisen, vol. 33, 1913, p. 851 (revised). Quoted, Bureau of Mines Bulletin, No. 77, p. 140.
[5] American prices based upon quotations in Chemical and Metallurgical Engineering and English pr upon quotations in the Iron and Coal Trades Review (London).


United States quotations
British prices since 1915 are on the basis of the current rates of exchange.

The British quotations reflect pretty closely the prices prevailing in France.

The above table shows a very great difference between American and western European prices in the summer of 1919, but a marked reduction in this difference by June, 1920. There was a slight decline in English prices—from 7 to 10 per cent—during the year covered, but a great reduction in American prices, amounting to about 50 per cent. It was during the latter half of 1919 that the imports of ferrochrome began to increase very rapidly, and this increased importation was the principal factor in the tendency toward an equalization of price levels in the two countries. In the summer of 1920 the prices of ferrochrome were still higher in this country than in England, although the difference between the two was less than a year before.

COMPETITIVE CONDITIONS.

The competitive strength of the industry devoted to the manufacture of ferrochrome depends mainly upon three things—the price of chromite delivered at the plant, the rate paid for electric power, and labor cost. Of these the first is the most important, constituting from 30 to 50 per cent of the total cost. In the United States the cost of electric power, while relatively less important than in the manufacture of electric furnace ferrosilicon, is still a big factor in determining competitive possibilities.

Cost figures for the year 1919 were secured from five producers of ferrochrome located in different parts of the country. They have been averaged on an arithmetical basis, i. e., on the basis of each company counting as one irrespective of the amounts produced.[8] These figures are classified and itemized as follows:

TABLE NO. 35.—*Cost per ton of producing ferrochrome in electric furnaces in the United States during 1919.*

Item.	Cost per ton of ferro-chrome produced.	Per cent of total cost.
Raw material	$117.24	42.7
Electric power	40.30	14.7
Labor	34.14	12.4
Supplies and tools	5.18	1.9
Electrodes	20.58	7.5
Repairs and maintenance	25.18	9.1
Manufacturing overhead	32.08	11.7
Total cost per ton	274.70	100.0

In the above tabulation raw material constituted about 43 per cent of the total cost, and electric power, which was the second most important item, 15 per cent. The cost of raw material averaged $117.24, of which the price of chromite at the plants of producers

[8] The reason for using this basis is that such a large proportion of the 1919 output is the output of one company that figures averaged on the basis of production would approximate too closely those of the company alluded to. It should also be stated that the cost of chrome ore reported by this company is not based upon actual prices paid for the ore used in 1919, but upon the selling prices of such ore at furnaces of the company, if such ore had been purchased during 1919. The company had accumulated an immense stock of ore during the war, which was utilized in part in 1919. The prices paid for the ore were abnormally high and much of it will probably never be used.

ated to $104.76, or nearly 40 per cent of the total furnace cost. averaged a little over 12 per cent of the total. Manufacturing ead constituted a relatively large item, but this included in the f some companies reporting certain selling and other expenses could not be readily separated from the manufacturing ead.

otal costs there was considerable difference among the con- eporting to the commission. The highest total cost was more ouble that of the lowest, the items of power, labor, and repairs aintenance being much larger than the corresponding items in orts of other concerns.

difficult to secure cost statements from producers abroad. In he Bureau of Mines published estimates of the cost of manu- ng ferrochrome in 1914 in Norway, France, and the United based upon certain assumptions concerning the location of in the countries named, prices of materials, rates of wages, e like.[7] As some of these assumptions do not allow enough te, coke or coal, and other material for the manufacture n of ferrochrome, a similar estimate was made for the commis- y a representative of one of the companies producing ferro- in the United States, who is also familiar with European ons as they existed prior to the outbreak of the war. It is d, according to this estimate, that the product had a carbon t of 8 per cent, that each plant had two 1,000-kilowatt furnaces out 2,000 tons of ferrochrome per year. One of these plants ated in Norway within 60 miles of the coast, another in France tzerland within 200 miles of the coast, and the third in the States within 200 miles of seaboard. The results are tabulated

o. 36.—*Estimated cost per ton of 2,000 pounds of producing ferrochrome in Norway, France or Switzerland, and the United States, in 1914.*

	Norway.		France or Switzerland.		United States.	
	Cost of unit.	Total cost.	Cost of unit.	Total cost.	Cost of unit.	Total cost.
,000 pounds	$15.00	$33.75	$15.00	$33.75	$20.00	$45.00
, 1,500 pounds	5.00	3.75	5.00	3.75	6.00	4.50
80 pounds	.03	2.40	.03	2.40	.04	3.20
ilowatt per year, including 85 oad factor	8.30	8.30	9.00	9.00	26.66	26.66
alaries	1.65	5.40	1.65	5.40	2.80	29.85
d maintenance	.....	2.50	.....	3.00	.....	6.00
on and depreciation at 5 per	.....	5.00	.....	5.00	.....	5.00
6 per cent on $200,000	.....	6.00	.....	6.00	.....	6.00
pense and packing	.....	3.00	.....	3.00	.....	6.00
	.....	70.10	.....	71.30	.....	152.21

m for 8 hours.

e above estimate it will be observed that the price of chromite, ense of electric power and labor cost constituted about 65 t of the total cost in Norway and in France or Switzerland and

f Mines, Bulletin No. 77, p. 139.

75 per cent in the United States. The big items of difference between costs in this country and those in Western Europe were electric power and labor.

It should be said in connection with the above tabulation that some items in the European costs are probably estimated too low. Labor cost in Norway was probably 40 per cent greater in 1914 than the above figures indicate and 20 to 25 per cent greater in France.

Coal and coke were at least as high in Norway as in the United States, and higher in France. These considerations and others which might be cited would tend to reduce the difference between the expenses of production in this country and those of Western Europe.[8] Roughly speaking, however, the table does show with some approximation to truth the variation in costs as they existed in the two continents just prior to the outbreak of hostilities, and to what items in the total expense the difference is mainly due.

Since 1914 costs have advanced very materially, those in the United States having about doubled. The item showing the greatest advance was chromite. Under normal conditions and with proper shipping facilities there would be no reason to believe that chromite should cost the producer in the United States much, if any, more than it costs his competitor in Europe. The items of electric power and labor do exhibit material differences in costs. Electric power in France and Norway, as was shown in the treatment of ferrosilicon, was much cheaper just prior to the war. Power costs have advanced in those countries since 1914, but they are still much lower than they are in this country.[9] The rates of wages are also greater here than abroad. With practically the same kind of furnaces used in this country and Western Europe and the same number of laborers required per furnace, these higher rates mean a greater labor cost per unit of output.

Ocean freights on chromite are an important determinant of the competitive positions of manufacturers in the United States and Europe. From the standpoint of geographical position the American producer should be at no serious disadvantage compared with the French and Norwegian manufacturers in getting this raw material from New Caledonia or Rhodesia. Freights from South Africa to Norway are reported to be less than to the United States, Norwegian tramp vessels taking chrome ore supplies to Norway at low rates and mostly as ballast. Ore from South Africa to the United States is transported almost entirely on the vessels of one steamship line.

A factor operating for the present in favor of the European producer of ferrochrome and other alloys is the low rate of foreign exchange. Before the war an ounce of gold was practically equivalent to 100 francs in French currency or nearly $20 in American money. At present (1920), according to the current rate of exchange, it is worth nearly 300 francs in French currency, while its value in

[8] It is also probable that labor and salaries are estimated too high for the United States. Thus, in 1914, according to the tabulation, labor and salaries constitute between 20 and 25 per cent of the total cost. In 1919 labor was only 11 per cent of the total. While salaries are not included in the cost statement of 1919 under the head of labor, they do not wholly account for the reduced percentage of labor cost that year as compared with 1914. The great increase in the price of chromite and other expenses did serve to reduce the percentage of labor cost, but this item was probably overestimated in 1914.

[9] Owing to the monetary conditions prevailing on the Continent of Europe, it is impossible to give definite figures with reference to power costs. There have been advances but they are much less than increases in the prices of commodities. At Niagara Falls, N. Y., no increase in power costs have taken place since 1914, but in other parts of the country advances in rates have been considerable.

terms of American money remains the same. Such a radical alteration within a comparatively few years is usually accompanied by a considerable lag in the adjustment of prices to new monetary standards, especially in regions where trade has been subject to considerable interruption or where industrial operations are only remotely influenced by world conditions. Such a situation may work for a time to the disadvantage of the American producer in purchasing raw material abroad. This disadvantage is said to exist.[18] The fluctuations and uncertainties of foreign exchange preclude any attempt to state the situation at any particular time in a way that will hold good for any considerable period. Attention, however, is called to it as a factor that should be noted.

Summing up the competitive situation, the following conclusions may be drawn:

(1) The principal factors determining the competitive strength of American and foreign producers are the cost of chromite, the price of power, and labor cost. In the United States in 1919 the first constituted about 50 per cent of the total cost, the second about 15 per cent, and the last about 12 per cent.

(2) Under normal conditions and with the same transportation facilities the American producer would get his chromite about as cheaply as his European competitors. There is, however, considerable evidence that French and Norwegian manufacturers get their chromite cheaper than producers in the United States.

(3) With reference to electric power and labor the French, Norwegian, and Swiss producers of ferrochrome have decided advantages over American manufacturers. Their electric power, while more costly than formerly, is less expensive than electric power in the United States. The rates of wages are also less and are not counterbalanced, as in so many other industries, by the possibility of a greater output per man employed.

TARIFF CONSIDERATIONS.

The tariff problems involved in the manufacture of ferrochrome relate to tariff classification, competitive conditions, compensatory duties, and possible revenue.

With reference to tariff classification, no special problem arises so long as ad valorem duties are imposed. Neither is there any situation similar to that already discussed in the case of ferrosilicon, where an ad valorem rate may result in an unduly low price being established in the exporting country. If, however, specific rates are established, account should be taken of the chromium and the carbon contents of the imported product. Such rates would vary with the chromium content. Little or no change in rates is necessary where the carbon content ranges between 4 and 10 per cent. When, however, the carbon constituent goes below 2 per cent the cost of production rises rapidly, being nearly double that of the high carbon grades when 1 per cent is reached. The carbon-free ferrochrome, made by the aluminum process, is relatively expensive. It generally sells at a price about three or four times that of the ordinary electric-furnace grades.

[18] Engineering and Mining Journal, Jan. 3, 1920, pp. 6, 7.

Competitive conditions favor producers in France, Norway, and other western European countries as against American manufacturers. Ordinarily the principal advantages of the foreign producer are due to the lower cost of water power and lower wages paid furnace workers. These advantages, however, cover less than 30 per cent of the cost of manufacture as averaged in this country in 1919. Geographically the United States is as favorably situated with respect to the great chromite deposits of New Caledonia and Rhodesia as Norway or France. Much chromite, however, is shipped to western Europe at very low rates in ballast, enabling the producer there to get his ore at relatively low prices. The uncertainties and fluctuation of foreign exchange are also said to operate somewhat to the disadvantage of the American ferroalloy producer.

At the present time (1920) no question of compensatory duties arises in the manufacture of ferrochrome, as chrome ore or chromate of iron is admitted free. There have been, however, recent proposals in Congress that a duty be imposed on chrome ore. The recovery of metallic chromium in the manufacture of ferrochrome of ordinary carbon grades, 4 to 8 per cent, ranges from 80 to 90 per cent, but is much lower when the carbon content becomes less than 2 per cent—barring the carbon-free alloy made by the aluminum process. When the carbon percentage reaches 1, the recovery is as low as 45 per cent. In the carbon-free product made by the aluminum process recovery is somewhat above 80 per cent.

In the manufacture of chrome steels the question of compensatory duties is less urgent than in that of some alloy steels, as the percentage of chromium is generally very small. The chromium content is, however, appreciable and adds materially to the value of steel. When the electric furnace is used in the manufacture of steel, recovery is about 100 per cent, but when the open-hearth process is employed it is around 80 or 85 per cent on the average.

The imports of ferrochrome do not aggregate sufficient to make them an important source of revenue. In 1919, with an importation of 926,616 pounds, the revenue yielded amounted to only $15,060. In 1911 (fiscal year), when the act of 1909 was in operation and the imports greater than those of any previous or succeeding fiscal year,[1] the revenue collected amounted to $19,591.

[1] Barring the fiscal year of 1920, for which the returns have not yet been published.

TUNGSTEN METAL AND FERROTUNGSTEN.

DESCRIPTION.

Tungsten, like chromium, is used mainly in making certain alloy steels. It is added to steel either in the form of metallic powder, from 96 to 99 per cent pure, or as a ferro-alloy with a tungsten content, which in the United States is usually over 70 per cent. Tungsten alloys with iron in all proportions, but commercial ferrotungsten generally has a tungsten content ranging from 70 to 85 per cent. The constituents of the metal and ferro-alloy can be seen from the following specifications taken from an English letter dated June 26, 1920.

	Tungsten metal.	Ferro-tungsten.		Tungsten metal.	Ferro-tungsten.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Tungsten	98.00–99.00	80.00–85.00	Tin	0.015	0.20
Carbon	.20	.30	Phosphorus	.015	.04
Silicon	.25	.80	Sulphur	.05	.05
Manganese	.02	.50	Calcium	.10	.20
Copper	.015	.10	Arsenic	.10	.05

In the above specifications for ferrotungsten the iron content would range from 12 to 17 per cent. It is desirable to have the percentages of such ingredients as tin, copper, phosphorus, and arsenic as low as possible. If too large they seriously impair the quality of the steel to which the tungsten is added.

A small amount of carbon is desirable. The electric furnace product generally contains 0.3 or 0.4 per cent, although low-grade ferrotungsten, which is not now a commercial product, may have 2 to 3 per cent or more carbon. Steel makers generally demand 0.5 per cent carbon as a maximum.

Carbon-free ferrotungsten is made is limited quantities, a typical analysis of which is the following:

	Per cent.		Per cent.
Tungsten	78.19	Phosphorus	0.03
Silicon	.60	Manganese	.30
Aluminum	.24	Carbon	Technically free.
Sulphur	.04	Iron	Balance.

Uses.—The greatest use of tungsten metal and ferrotungsten is in the manufacture of tool steels, especially those known as "high-speed" steels. For half a century or more a small amount of tungsten (2 to 5 per cent) has been used to make steel self-hardening, i. e., a tool made of this steel need only be allowed to cool in the air and it becomes hard without the ordinary quenching or chilling operation. In large proportions (10 to 25 per cent) tungsten makes a steel

which stays hard even when red hot. A tool of this material can be run so fast on a lathe that it gets red hot from friction and yet remains hard and keeps on cutting. Productive efficiency is greatly increased, and it has been asserted that under favorable conditions one man and one lathe can do as much work with high-speed tungsten steels as five men and five lathes could formerly do with simple carbon steels.[1]

"High-speed" steels usually contain from 13 to 18 per cent tungsten. Other ingredients are chromium and vanadium. Typical high-speed steels, according to one authority, contain the following alloys:

	Per cent.	Per cent.
Tungsten	18	13
Chromium	3.50	4
Vanadium	.75–1	1.75–2.25

Other uses of tungsten are the making of permanent magnets and the manufacture of incandescent electric-lamp filaments. Steel containing 4 to 5 per cent tungsten and 0.5 to 0.7 per cent carbon, if heated to red heat and then quenched in water, will retain its magnetism better than ordinary hardened carbon steel. The percentage of tungsten consumed in the making of filaments for incandescent electric lights is small, but this use is a well-known one.

Another recent use is in the automobile industry. The valves of some automobile engines are made of iron-tungsten alloy and are said to stand the wear much better than ordinary iron or steel.

RAW MATERIAL.

The raw material of tungsten metal and ferrotungsten consists of tungsten-bearing ores, of which there are four commercial varieties, scheelite or tungstate of lime, ferberite or tungstate of iron, huebnerite or tungstate of manganese, and wolframite or iron-manganese tungstate. The value of tungsten ore depends upon its content of tungsten, which is invariably expressed in terms of tungsten trioxide (WO_3). The ore as mined rarely contains more than a very small WO_3 content and requires to be concentrated before it can be utilized as a commercial product. The standard "ore" is therefore a concentrated product containing approximately 60 per cent tungsten trioxide.

Tungsten-bearing ores are found in the United States, particularly in the States of California and Colorado. The former State has been the largest producer of scheelite in the world, and the latter the only region in the world producing ferberites in commercial quantities. Domestic ores contain little of the harmful ingredients that make some of the imported ores unsuitable for the manufacture of ferrotungsten by the electric-furnace method.

A large part of the tungsten-bearing ores used in the United States is imported. Before the war Germany furnished this country with

[1] Tungsten Minerals and Deposits. By Frank L. Hess, U. S. Geological Survey, Bulletin No. 652, p. 15.

about two-thirds of its imported supply. In this ore trade Germany acted as an intermediary, as its domestic output was small. After the outbreak of hostilities in Europe American comsumers began to draw supplies direct from South American sources, a great part of which was mined in Bolivia. At the present time (1920) the imported supply comes largely from China, where there are extensive deposits of tungsten-bearing ores which are readily and cheaply mined.

The large and increasing importation of ore from China during the latter part of 1918 and 1919 caused a marked reduction in the price of this raw material. In 1917 the average domestic price of scheelite was $22.75 per unit,[2] WO_3, and of wolframite, $21.34. In 1918 they were, respectively, $24.958 and $24.325 per unit. In 1919 prices fell, owing largely to the cancellation of Government contracts for war material and the continued importation from China. In 1919 domestic mines were closed, and quotations for American ore were largely discontinued. One of the largest producers of ferrotungsten in this country secured wolframite that year at $6.25 to $6.75 per unit of WO_3 guaranteed 60 per cent WO_3 or over, and scheelite for $7 to $10 per unit of WO_3 guaranteed 60 per cent WO_3 or over. In the spring of 1920 tungsten-bearing ores were selling in this country at about $6.50 per unit of WO_3. In December the price had fallen to between $3.50 and $4.25 per unit of WO_3.

It is claimed that American mines producing these ores can not operate profitably when the price is less than $17 per unit. The Atolia Mining Co. shut up its mines when the price sank to $12.

The imported ore generally has a higher tungsten content than the domestic product. Some of it grades down to 50 per cent WO_3, but the average is close to 60 per cent. It is rarely free from objectionable impurities. The Chinese product contains too much tin, arsenic, and sometimes copper, to be treated directly by electric-furnace plants. It is, however, bought in large quantities by companies equipped to treat it by chemical processes.

In addition to tungsten-bearing ores, lime, fluorspar, coke, and charcoal are used in the manufacture of ferrotungsten.

METHODS OF PRODUCTION.

Ferrotungsten was first made by reduction in crucibles. This process generally yielded a powder unless the ferroalloy was very low grade and could be easily fused. In making a 30 per cent alloy the crucible would last about three heats, but in making a 75 per cent product it was good for only one heat. At the present time, however, ferrotungsten in the United States is, for the most part, made in electric furnaces, with carbon as a reducing agent. A small amount of carbon-free ferrotungsten is manufactured by the thermit process, with powdered aluminum as a reducing agent.

In 1919 there were nine ferrotungsten producers in Great Britain of whom two used the electric furnace and the remainder the thermit process. A recent development in the use of the latter process is the substitution of 85 per cent ferrosilicon for powdered aluminum in the production of carbon-free ferrotungsten. High recoveries are obtained, and the product contains about one-tenth of 1 per

[2] The unit is 1 per cent of the ton—22.4 or 20 pounds.

cent of carbon. There is, however, some difficulty encountered in keeping the silicon low.

In the United States the greater part of the American and other ores is reduced to ferro-alloy in electric furnaces. Impure ores, or those containing too much tin, copper, or other objectionable ingredients, have to be treated by some process by which impurities can be eliminated in order to be available for the electric furnace. Tin and copper can be eliminated by the electromagnetic process, although the expense is such as to add materially to the cost of producing the alloy.

Impure ores, however, can be treated by the wet process which is used in the manufacture of metallic tungsten powder. This method was largely used in Germany before the war. There are several American plants now equipped for treating ores by this process. The wet process is distinctly a chemical method involving fusion with soda ash, leaching out the sodium tungstate thus formed and precipitating nearly chemically pure tungstic acid (H_2WO_3) by means of calcium chloride and hydrochloric (muriatic) acid. The precipitate is purified by ammonia and nitric acid, dehydrated, and reduced to metal either in a stream of hydrogen or by heating with carbon in crucibles. Both methods produce tungsten powder, the former being used for making extremely pure metal for incandescent lamp filaments, and the second for use in steel manufacture.

RECOVERY.

As in the cases of the iron-manganese alloys and ferrochrome, there are some losses of metal in the manufacture of the ferro from the ore and in the alloying of steel. The recovery of metallic tungsten from the ore to ferro-alloy varies with the ore used and the grade of alloy produced. It is higher in the case of scheelite than in the case of wolframite and greater in the high-carbon than low-carbon grades of the alloy. Statements from different companies therefore vary.

A few statements concerning the experiences of different companies may be made. One producer gives the recovery in the manufacture of the alloy as 80 to 85 per cent when scheelite is used. According to the figures of another company it takes about 136 pounds of tungsten in the concentrate to make 97 pounds in the ferro-alloy. At the office of a third company a memorandum, referring to the Timberlake bill proposing a duty on tungsten-bearing ores, makes the following statement:

NOVEMBER 25, 1919.

Memorandum for Mr. ———:

The proposed tariff of $10 per unit of WO_3 on tungsten concentrates shipped to this country will have the effect of increasing the cost per pound of ferrotungsten $1 per pound. This is arrived at as follows: $10 per unit=50 cents per pound WO_3. The unit of conversion used to convert WO_3 into W in the ore is 0.7931. Dividing 50 cents by 0.7931=63 cents per pound W in ore. Allowing 85 per cent recovery of W in finished ferrotungsten, the 63 cents by 0.85=74.2 cents per pound tungsten in ferrotungsten. Adding proportion of conversion cost, say, 10 cents, and figure an allowable profit of 15 per cent, brings the additional cost of completed ferro to $1 per pound.

Disregarding the allowed profit, the assumed recovery of metallic tungsten is 85 per cent. Another authority gives the same metallic recovery as an average when the ore is ferberite and the concentrate

is 60 per cent WO_3. When a low-carbon ferro-alloy is produced there is a further refinement with a consequent added loss.

In the manufacture of high-speed steel there are tungsten losses which are considerable in the aggregate. These losses are partially recovered. In the process of manufacture there are scrap, recogging, and finishing losses, and in addition scale losses in each of the three stages mentioned. Figures taken from the books of one of the largest producers of high-speed steel in the country showed the following recoveries:

(1) 10 tons of ingots resulted in 5.52 tons recovered.
(2) 10 tons of ingots resulted in 5.02 tons recovered.
(3) 10 tons of ingots resulted in 5.18 tons recovered.

It should be said in this connection that part of the loss indicated by these figures is recovered in other operations.

An average recovery in good practice from ferrotungsten to high-speed steel would be 18 pounds of tungsten out of 23 pounds in the alloy.

GEOGRAPHICAL DISTRIBUTION AND ORGANIZATION.

Ferrotungsten and tungsten metal are produced in Pennsylvania, New York, New Jersey, and Colorado. The first of these States produces by far the largest amount. The carbon-free alloy is made in New Jersey.

During the war there were some signs of a tendency for ferroalloy manufacturers to move toward the sources of raw material in this country. The Tungsten Products Co. established a plant in Colorado, and the industry existed for a time in California. This movement, however, did not continue after the war, domestic mines having practically all closed. At the present time the principal producers are near steel centers where the alloy is marketed and not far from New York where the greater part of the foreign ore is landed.

The production of commercial ferrotungsten and tungsten metal is distributed among some six or eight different companies, no one of which can be said to have an output large enough to exercise a monopolistic influence. In addition to these concerns, some manufacturers of tool steel and high-speed steel have made ferrotungsten for their own use. Most producers make other alloys or manufacture steel.

The capital required in this industry is not very large. Some companies have invested large sums in the making of ferrotungsten, but much of this investment went into the mining of ore rather than into the manufacture of ferroalloy.

PRODUCTION AND CONSUMPTION.

Statistics with regard to the country's output of ferrotungsten and tungsten are not complete. According to figures published by the Geological Survey, the shipments of ferrotungsten of domestic manufacture of 50 per cent of more tungsten amounted to 1,258 gross tons in 1917 and 2,142 gross tons in 1918.[3] In 1919 production declined, amounting to something over 1,000 tons.

Prior to the war the consumption of ferrotungsten and tungsten metal was greatly in excess of production. Some ferrotungsten and

[3] Geological Survey: Iron Ore, Pig Iron, and Steel, p. 570.

tungsten metal were produced by manufacturers of alloy steels for their own use and by other concerns like the Primos Chemical Co., the Electro Metallurgical Co., and the York Metal & Alloys Co. A large part of this production was in the form of metallic tungsten.

In 1913 over half of the tungsten metal and ferrotungsten consumed in the United States was imported.[4] There were no exports. In the years 1916 to 1918 tungsten metal and ferrotungsten were exported, and during these years exports exceeded imports. In 1918 the imports amounted to only 1 gross ton while exports aggregated 975 gross tons.

The excess of production over consumption during the last 3 years of the war was only a temporary condition. In 1919 imports again exceeded exports, the figures for the (calendar) year being 177 gross tons and 17 gross tons, respectively.

THE WORLD'S FERROTUNGSTEN SITUATION.

Before the war Germany produced the greater part of the world's supply of tungsten metal and ferrotungsten. Much ore was exported from the United States to be refined in that country and returned to this in the form of metal or ferro. France was the only other European country that had any considerable tungsten smelting industry. Germany imported her ore very largely from British possessions and smelted it for sale to other countries. Technical progress in that country had gone so far that the cost of production was much below that in any other country.

Since 1914 the United Kingdom, which had produced practically no tungsten, has built up an industry for the production of tungsten metal and ferrotungsten which is now (1920) sufficient for all home needs and for the accumulation of a surplus for export. The market for tungsten ores from British possessions has been shifted, probably permanently, from Germany to England. The smelting of the world's tungsten-bearing ores is now carried on in England, France, and the United States.

In England, where at the beginning of the war almost no tungsten or ferrotungsten was produced, an association was formed of the principal steel manufacturers, who have contributed to the establishment of plants sufficient to supply the entire war demands. There are strong indications that England intends to continue the system of centralized purchase of the whole tungsten output of the Empire. The capacity for producing ferrotungsten and tungsten metal was so enlarged through war demands that England and the United States alone could practically supply the entire world's demand, even allowing for the broadened use of tungsten and its alloys.

IMPORTS AND EXPORTS.

The imports of tungsten metal and ferrotungsten have varied greatly during the past decade (1910–1919). In the fiscal year 1913 they aggregated over 654 long tons, while in 1918 they amounted to only 1 ton. The imports for consumption, with revenue collected, are shown for the years 1910 to 1919, inclusive, in the following table:

[4] Figures obtained by the Tariff Commission for the year 1913 showed a production in this country of about 569 tons. The importation for the fiscal year 1913 was 654 tons.

TABLE No. 37.—*Imports for consumption of tungsten and ferrotungsten and revenue collected for years 1910–1919.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Tons.*				*Per cent.*
1910	20 per cent	387	$474,254	$94,850	$1,224.70	20.00
1911	do	294	368,618	73,723	1,251.67	20.00
1912	do	133	151,267	30,253	1,132.83	20.00
1913	do	654	795,467	159,093	1,215.75	20.00
1914	do	67	87,276	17,455	1,302.63	20.00
1914	15 per cent	317	382,779	57,416	1,205.60	15.00
1915	do	31	38,351	5,752	1,237.13	15.00
1916	do	28	117,658	17,648	4,202.07	15.00
1917	do	10	40,053	6,007	4,005.30	15.00
1918 [1]	do	1	3,614	542	3,614.00	15.00
Calendar year:						
1919	do	[2] 396,460	287,981	43,197.15	.73	15.00

[1] For fiscal year which closed June 30, 1918. No figures are published separately in Commerce and Navigation for the 6 months from July 1 to Dec. 31 for tungsten and ferrotungsten. The importation, however, was very small. The figure for 1919 (calendar year) is very largely the importation of the last 6 months.
[2] Pounds.

No figures are separately published for imports of tungsten and ferrotungsten by countries. Prior to the war the bulk of these imports came from Germany. Now they come from England. During the war imports declined, but after the signing of the armistice they began to increase—slowly at first and then very rapidly.

During the war tungsten and ferrotungsten began to be exported. In 1915 the value of these exports amounted to $450,802, of which the United Kingdom took $344,971. In 1916, 128,713 pounds, valued at $184,876, were exported. The principal countries of destination, with amounts and value of exports in 1916, were the following:

	Quantity.	Value.		Quantity.	Value.
	Pounds.			*Pounds.*	
United Kingdom	49,884	$49,117	Russia in Europe	18,781	$50,952
Sweden	35,599	44,607	Canada	16,930	31,315

The exports for 1917 were much larger, amounting to 1,784,306 pounds, valued at $3,597,426. The principal countries of destination with value of exports were as follows:

	Quantity.	Value.		Quantity.	Value.
	Pounds.			*Pounds.*	
Italy	791,057	$1,444,594	Russia in Europe	59,752	$253,691
United Kingdom	595,406	1,321,803	Germany	55,125	137,812
France	198,074	219,267	Canada	54,566	116,622

The exports for the fiscal year 1918 show a still further increase, followed by a decided fall after the signing of the armistice. Table No. 38 shows the exports for the fiscal year 1918, the second half of 1918, and the calendar year 1919.

TABLE NO. 38.—*Exports of tungsten and ferrotungsten, 1918 and 1919.*

Exported to—	Fiscal year 1918.		July–December, 1918.		Calendar year 1919.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
France	960,776	$1,989,417	127,649	$286,500		
Italy	1,128,198	1,905,189				
Spain					150	[illegible]
Sweden					23,847	57,[illegible]
Switzerland	235	439			1,400	4,[illegible]
United Kingdom	34,571	46,340			1,290	13,[illegible]
British West Indies	20	25				
Canada	57,696	109,500	22,936	54,634	11,059	25,097
Mexico	18	18				
Cuba	2,525	3,751			60	149
Brazil	735	1,758			49	129
Argentina			225	770		
British India			2,240	6,500		
Australia					43	109
British South Africa					222	532
Total	2,184,769	4,056,437	153,050	348,404	38,130	113,276

It will be observed that after the pressure of war demands had ceased exports dropped off. In the calendar year of 1919 the exports of tungsten metal and ferrotungsten were less than one-fourth those of the last six months of 1918. Imports on the other hand increased.

PRICES.

The price of ferrotungsten is quoted by the pound of contained tungsten and hence rises in value as the tungsten content increases. It also rises with the decline in carbon content. Standard ferrotungsten contains from 75 to 85 per cent metallic tungsten and less than 1 per cent carbon. Ferrotungsten containing less than 70 per cent tungsten and more than 1 per cent carbon is not readily sold.

Tungsten metal, on account of its greater freedom from deleterious ingredients (see analyses p. 109), usually sells at a higher price than the tungsten in the ferro. This difference varies appreciably, but ordinarily the metal is quoted about 20 per cent higher than the alloy.

In 1914 just before the outbreak of the World War, German ferrotungsten was selling in the United States at $0.90 to $1.025 per pound of contained tungsten. Immediately after the commencement of hostilities prices fell. They began to rise again in 1915, and in the spring of 1916 went as high as $8.50 per pound of tungsten content. Later that year, however, prices fell to $2.50 per pound. The monthly averages [5] for the years 1917 to 1920, inclusive, are shown in the following table:

[5] Quotations taken from Chemical and Metallurgical Engineering.

TABLE NO. 39.—*Prices per pound of contained tungsten of ferrotungsten (75–85 per cent W), f. o. b. Pittsburgh, 1917–1920.*

	1917	1918	1919	1920
January	$2.30	$2.35–$2.45	$2.35–$2.40	$1.25–$1.40
February	2.00	2.35– 2.45	.....	1.25– 1.40
March	2.10	2.30– 2.40	.....	.97– 1.16
April	1.95	2.30– 2.35	1.30– 1.50	.90– 1.10
May	2.00	2.30– 2.37	1.30– 1.60	.90– 1.10
June	2.00	2.35– 2.40	1.30– 1.60	.90– 1.10
July	2.50	2.35– 2.40	1.30– 1.60	1.00– 1.13
August	2.60	2.35– 2.40	1.35– 1.60	1.10– 1.15
September	$2.60– 2.65	2.35– 2.40	1.25– 1.50	1.10– 1.15
October	2.60– 2.65	2.35– 2.40	1.25– 1.40	.88– 1.01
November	2.40– 2.60	2.35– 2.40	1.25– 1.40	.76– .90
December	2.35	2.35– 2.40	1.25– 1.40	.68– .79
Yearly average	2.30	2.37	1.49	1.05
Highest monthly average	2.65	2.45	2.40	1.40
Lowest monthly average	1.95	2.30	1.25	.68

During the war the price of ferrotungsten ranged from two to eight times what it was immediately before the commencement of hostilities. The usual price for standard-grade material was $2 to $2.65 per pound of contained tungsten. After the armistice prices fell, and in the spring of 1920 were practically at the prewar level. In December, 1920, the quoted prices of ferrotungsten (70 to 80 per cent grade) were 65 to 80 cents per pound of contained tungsten.

British prices in general were quoted lower than American prices. Since the signing of the armistice they have ranged from 25 to 50 cents less. In the following table a comparison is made between British and American prices for the year ending June, 1920 on the basis of the normal and current rates of exchange.

TABLE NO. 40.—*British and American prices of ferrotungsten (70–85 per cent W) compared for year ending June 30, 1920.*[1]

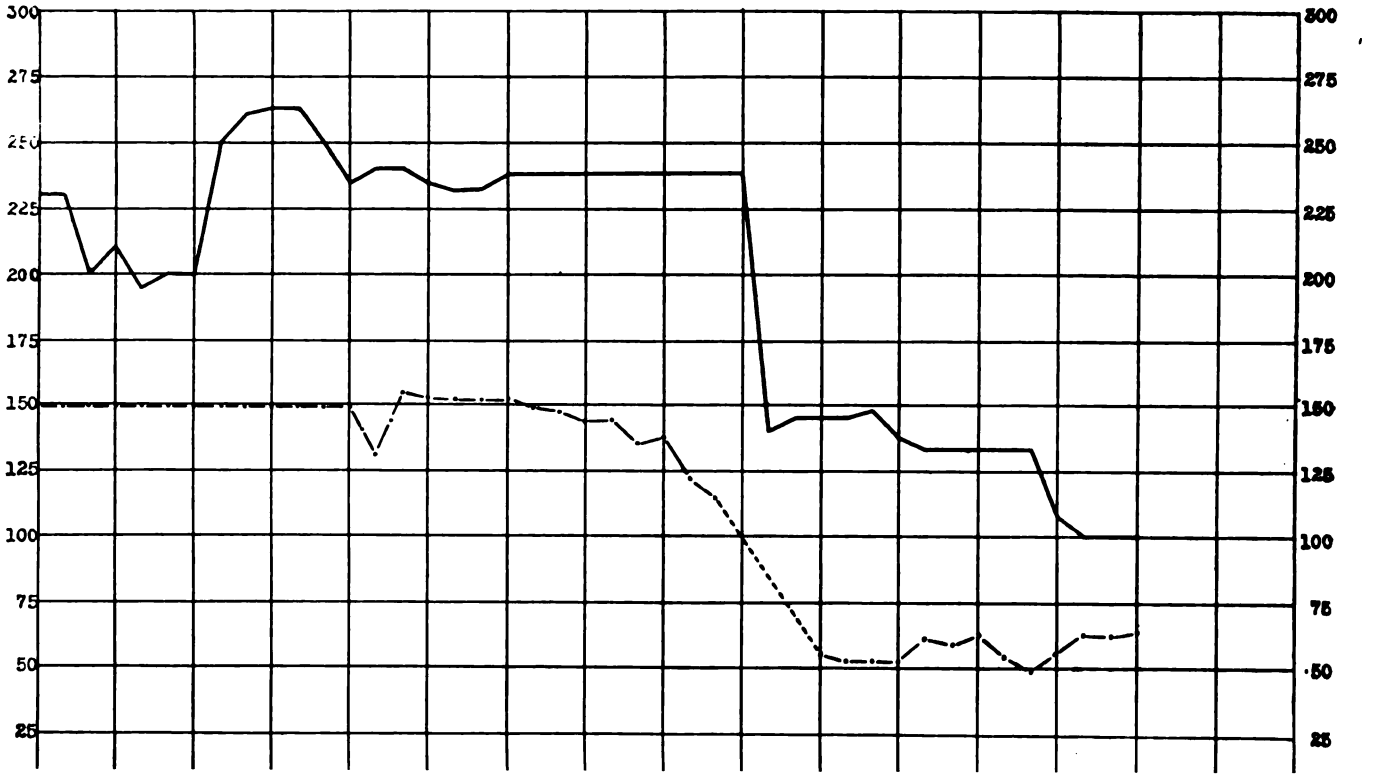
Months.	British prices (per pound of contained W).			American prices (per pound of contained W).
	English currency.	In American currency.		
		Normal rate of exchange.	Current rate of exchange.	
1919.	£ s. d.			
July	0 2 11	$0.71	$0.53	$1.30–$1.60
August	0 2 11	.71	.53	1.35– 1.60
September	0 2 11	.71	.53	1.25– 1.50
October	0 2 10 1/2	.70	.61	1.25– 1.40
November	0 2 10 1/2	.69	.58	1.25– 1.40
December	0 2 9 1/2	.69	.40	1.25– 1.40
1920.				
January	0 2 10	.69	.54	1.25– 1.40
February	0 2 9 1/2	.68	.49	1.25– 1.40
March	0 3 0	.73	.55	.97– 1.16
April	0 3 2	.77	.63	.90– 1.10
May	0 3 3	.79	.63	.90– 1.10
June	0 3 3	.79	.64	.90– 1.10

[1] Quotations of British prices are taken from the Iron and Coal Trades Review, London, and are for Sheffield Steel Works, England. Those for American prices are from Chemical and Metallurgical Engineering and are for Pittsburgh, Pa.

CHART No. 4.—UNITED STATES AND BRITISH PRICES OF FERROTUNGSTEN (70-80 PER CENT PER POUND OF CONTAINED W.) FROM JANUARY, 1917, TO JUNE, 1920, INCLUSIVE.

[Cents per pound.]

United States quotations ———— British home quotations —.—.—.—.—.—.—. No quotations available .....



The differences between the quoted prices of American and of British ferrotungsten are very marked at the normal rate of exchange, and at the rates of exchange current during the year for which the quotations are made are still more pronounced. It should be said, however, in this connection, that the American quotations range somewhat higher than the average prices received by producers. The differences, nevertheless, are very great.

COMPETITIVE CONDITIONS.

Ferrotungsten is a high-priced ferro-alloy. The cost of the tungsten-bearing ore utilized in producing the ferroalloy forms a large part of the price at which it sells. In 1917 when the prices of ferrotungsten were nearly two and a half times those of the present time (1920), the cost of ore constituted over two-thirds of the selling value. At that time the average price of tungsten-bearing ore in this country was $21.67 per unit (20 pounds) of 60 per cent WO_3 in tons of 2,000 pounds. As the conversion factor from tungstic acid to tungsten metal is 79.3, the cost per pound of metallic tungsten in the concentrate was $1.374. As the average basis for recovery in the electric furnace is taken to be 85 per cent, the cost of the concentrate per pound of tungsten in the ferrotungsten manufactured was $1.616. The quoted prices of ferrotungsten during the year 1917 averaged $2.30 per pound of contained tungsten. Hence the raw material out of which the ferroalloy was manufactured constituted about 70 per cent of its quoted selling price for the year named.

In England during the same year the maximum price per long-ton unit (22.4 pounds) of 65 per cent tungsten concentrate f. o. b. Liverpool, was fixed at 60 s. ($14.60). This was equivalent to $0.652 per pound of tungstic acid. Allowing the same percentages for the conversion factor and basis of recovery in electric smelting as in the United States, the cost to the English manufacturer of the raw tungsten used in the production of ferrotungsten was $0.967 per pound. The maximum price fixed by the British Government in 1917 on 75 per cent ferrotungsten produced and sold in England was 6 s. 2½ d. ($1.506) per pound.

It will be noticed that the tungsten in the concentrate was $0.65 per pound less in England than in the United States, and the price of ferrotungsten about $0.80 cheaper. The spread between the metal content and the ferroalloy in England was approximately $0.54, and in the United States, about $0.70.

The British war prices, however, both of the ore concentrate and of the ferroalloy and the tungsten metal were probably lower than they would have been if they had not been controlled by the Government. Export prices of iron and steel goods generally and of articles used in their manufacture were much higher than the prices fixed for England.

Making allowance for the more or less artificial conditions brought about by the war the cost of ferrotungsten was in all probability considerably less than in the United States. During the war Great Britain relied for the most part upon tungsten-bearing ores from Burma, Portugal and parts of South America which were largely surface deposits and therefore cheaply mined. The United States

relied largely upon domestic ores which were mined at considerable expense. The price of ore being such a large fraction of the selling value of the ferroalloy, the advantage which England had with reference to the cost of its ore would enable that country to produce the alloy more cheaply.

The close of the war found American producers using to a considerable extent domestic ores. The sudden decline in the demand for ferrotungsten, combined with large stocks of the alloy for which there was little demand, left the domestic producer confronting a relatively high cost for his raw material and a suddenly restricted market for his finished product.

During the year 1919 English ferrotungsten began to be imported in considerable amounts and was sold at prices below those quoted for the domestic product. The American manufacturer had purchased domestic ores at high prices and was now obliged to dispose of his alloy below cost.

Figures compiled from cost statements for 1919 of manufacturers in this country show that the expense of manufacture averaged but little below the prices quoted for that year, and considerably above those prevailing during the first six months of 1920. In these cost statements the price of ore was over 80 per cent of the total cost.[6]

The use of Chinese ores, which are now (1920) selling at less than half the prices formerly paid for American ores, will reduce the expense of manufacture in the United States. Early in 1920 English producers of tungsten metal and ferrotungsten were getting their ores at lower prices than American manufacturers. The quotations for ferrotungsten were materially lower in England than in the United States at the then current rates of exchange. (See above, Tables Nos. 39 and 40.) The ocean freight on ore from southern China and the banking charges connected with shipping are practically the same for England and the United States. It has been held, however, that the reduced rates of foreign exchange favors the British producer in getting his ore.[7] Whatever may be the merits of this contention the uncertainties and fluctuations of foreign exchange do affect the competitive position of the American producer, although a precise statement of this situation for any period is likely to be of little value for a succeeding period.

The conversion cost is a relatively small part of the total expense of production. In 1919 it was about 20 per cent of the total in the United States. There is no reason to believe that it is materially higher in this country than in England. The labor cost is greater on account of the higher prevailing rate of wages. Electric power, however, is as cheap in this country as in England, and this is a large item in the conversion cost.

A factor of minor but appreciable importance in the competitive situation is the utilization of waste material by foreign producers in the manufacture of by-products. The ingredients in tungsten-bearing ores which must be eliminated in the production of metallic tungsten and ferrotungsten, like tin and sulphur, are generally

[6] The statements are not tabulated, as the various items in cost were not given in all cases and were not wholly comparable.

[7] Charles Hardy, in Engineering and Mining Journal, Jan. 3, 1920, pp. 6 and 7, and Jan. 17, 1920, p. 211

wasted in this country but utilized abroad. This was particularly true of Germany before the war.[8]

Summing up the competitive situation, the following observations may be made:

(1) In the production of ferrotungsten the price of tungsten-bearing ore constitutes from 70 to 80 per cent of the total manufacturing cost.

(2) Whether due to foreign exchange or other causes, the English producer is getting his tungsten-bearing ores at a lower price than that paid by his American competitor.

(3) With reference to the items making up conversion cost, electric power, which is an important item, is as cheap in the United States as in England, that country not having the great advantages of cheap water power enjoyed by Norway, France, and other continental countries. Labor cost is higher in the United States on account of the higher prevailing wages. Labor cost is an appreciable but not large item in the total.

(4) The greater utilization of ingredients which have been largely wasted in the United States also favor the foreign manufacturer.

TARIFF CONSIDERATIONS.

The following are the most important problems with reference to tariff legislation.

1. *Classification.*—As long as ad valorem duties are imposed no question arises concerning the classification of tungsten and ferrotungsten. Where specific duties are imposed tungsten metal having a higher selling value than ferrotungsten—generally about 20 to 25 per cent—should be considered a higher graded product than ordinary electric furnace ferrotungsten. A division should also be made between ordinary ferrotungsten made in electric furnaces and the carbon-free product manufactured by the aluminum process. The latter process is more expensive and the product sells at a higher price.

2. *Competitive conditions.*—The cost of producing ferrotungsten and tungsten metal is higher in the United States at present (1920) than in England, our principal competitor. The British producer has apparently important practical advantages in the price which he pays for his ore as compared with the American manufacturer. He also has some advantages in labor cost and in the utilization of waste products.

3. *Compensatory duties.*—As long as tungsten-bearing ores are admitted free of duty no question arises with reference to compensatory duties in the manufacture of the alloy or metal. Duties, however, on tungsten-bearing ores are proposed in bills recently presented to Congress. In the manufacture of ferrotungsten some metallic tungsten is lost. A rough estimate of average recovery is 85 per cent of the metal in the concentrate. This recovery should

[8] The great technical advance of Germany in the chemical and metallurgical sciences accounts for that country's control of the trade in tungsten and ferrotungsten. The utilization of by-products as well as efficient organization of the manufacture of metallic tungsten and ferrotungsten enabled Germany to under sell her competitors in the world trade. It was this technical advance rather than control of the Burma ore fields, as often stated, which caused that country's superiority. As a matter of fact, Burmese ore which went to Germany in prewar times was sold through London houses.

be a basis for levying duties on ferrotungsten and tungsten r in case ore is made dutiable. Similarly a rough estimate shows in the manufacture of high-speed steel there is a loss of me tungsten from ferro to steel equivalent to the difference betwe and 18. In other words it takes about 23 pounds of metallic tun to add 18 pounds to steel.

4. *Revenue.*—In 1913 (fiscal year), when a 20 per cent ad val duty existed on ferrotungsten and tungsten metal imposed u the act of 1909, a revenue of $159,093 was collected on an imp tion of 654 tons. This importation was larger than that of other year in the country's history. In 1919 (calendar year), 396,460 pounds (198.23 short tons) were imported, the rev collected under the present 15 per cent ad valorem rate amou to $43,197.15.

OTHER FERRO-ALLOYS AND TARIFF PROBLEMS.

The industries concerned with the manufacture of the ferro-alloys already treated in this report are more or less affected by tariff legislation. The production of the remaining alloys to be discussed are either independent of such legislation or in such a state of development that the tariff situation can not be well defined. The manufactures of ferrovanadium and ferromolybdenum are strongly intrenched in this country and not threatened with any serious foreign competition. There is some importation of ferrophosphorus which may affect the manufacture of this ferro in the future, but at present it is too small to be a factor in the domestic industry. The manufacture of ferrotitanium is not threatened with any foreign competition on American soil, although the exported product meets some rivalry in foreign markets. Most of the other alloys are in the stage of experiment where international relationships can not yet be determined.

FERROVANADIUM.

DESCRIPTION.

Ferrovanadium is an alloy of iron and vanadium, with small amounts of other ingredients. American manufacturers report a product containing from 30 to 40 per cent vanadium. In addition to the ordinary ferrovanadium made largely in electric furnaces there is a carbon-free product manufactured by the aluminum process. Typical analyses of these two kinds are the following:

	Electric furnace ferrovanadium.	Carbon-free free vanadium.
Vanadium	34.00	38.50
Carbon	1.42	Technically free.
Silicon	.12	1.00
Aluminum	.12	1.00
Manganese	.12	.....
Sulphur	.03	.....
Phosphorus	.009	.....
Iron	64.10	Balance.

Ferrovanadium is an expensive alloy and sells by the pound of contained vanadium.

Uses.—The vanadium in this ferroalloy acts as a cleanser and deoxidizer in a steel bath. It causes deoxidation to go beyond the point obtained by ferromanganese and ferrosilicon. However, it is too expensive to be used as a deoxidizing agent. Ferrovanadium is employed to add vanadium to steel. Incorporated in steel in proportions up to 0.30 per cent vanadium toughens and adds great tensile strength to steel. Steels thus treated are unusually resistant to shock and alternate stresses. Hence they are very useful for axles, cranks, piston rods, and the like. Without vanadium the modern automobile and autotruck would be much weaker machines than they are.

Vanadium is also an important constituent of tool steels. In high-speed steel from 1 to 3 per cent vanadium is added.

RAW MATERIAL AND METHOD OF PRODUCTION.

Vanadium is a rare metal found principally as a black sulphide on the highlands of Peru or as an oxide in the radium ores of Colorado and Utah. The deposits in Peru consist of a sulphide of vanadium originally containing about 60 per cent sulphur and 20 per cent vanadium (patronite). The continued drain upon the Peruvian ore fields has reduced the vanadium content of these ores to a very great extent.[1] The ores of Colorado are oxides of vanadium (roscoelite),

[1] At present the best of these ores contain about 15 per cent vanadium. Formerly they contained 20 per cent. From both the Peruvian and Colorado fields the vanadium content in the ores used for the manufacture of ferrovanadium ranges from 1.25 to 15 per cent vanadium, the remaining constituents being 30 to 70 per cent silica and gangue material. It averages much higher in the Peruvian than in the Colorado field.

or of vanadium and uranium (carnotite). The Peruvian deposits are the principal source of the world's vanadium and furnish producers in the United States with much of their raw material. They are entirely controlled by American interests.

The black ore of Peru (patronite) is roasted and put into the condition of iron vanadium oxide before reduction. The reduction then takes place by the thermit process in which aluminum is used or in the electric furnace where the ore may be reduced directly with lime as a desulphurizing agent and carbon as a reducing agent. The other ores are treated by chemical or ore-dressing processes to obtain the vanadium as oxide or vanadate of iron, and are then reduced with carbon in a combustion or electro furnace or by the thermit method.

RECOVERY.

The recovery of vanadium from the ore concentrate to alloy varies greatly. One of the largest producers states that this percentage "varies from 40 per cent to 90 per cent depending on the process used." A fair average would be about 75 per cent.

ORGANIZATION AND GEOGRAPHICAL DISTRIBUTION.

Nearly the entire production of ferrovanadium in the United States is now controlled by one business organization, the Vanadium Corporation of America. This corporation in September, 1919, took over the plant of the American Vanadium Co. at Bridgeville, Pa., and its mines in Peru. On December 31, 1919, it took over the Primos Chemical Co., of Primos, Pa., and its ore properties in Colorado.

The Vanadium Corporation of America in June, 1920, had outstanding 373,334 shares of stock. This stock has no par value. An estimate of the value of all the properties of this company, exclusive of ore reserves, mine properties, and equipment, is $3,362,906.82.

The manufacturing plants of the Vanadium Corporation of America are located in Pennsylvania. Independent producers of this ferroalloy also exist in that State, but their outlay is relatively small. In New Jersey there is the plant of the Metal and Thermit Corporation which produces carbon-free ferrovanadium.

PRODUCTION AND CONSUMPTION.

The production of ferrovanadium in the United States far exceeds its consumption. In 1918, when the domestic output was at its highest, the output exceeded 2,700 short tons. There were no imports that year, while the exports amounted to 1,045 tons, or over one-third the home production.

In 1913 the country's output was a little over 800 tons, of which one-third was exported. There were no imports. In the calendar year 1919 production fell off from that of 1918. Imports amounted to 5.6 tons and exports to 32.31 tons.

FOREIGN PRODUCTION.

Figures regarding the production in foreign countries are not available. The foreign output, however, is not large. Germany was getting vanadium from the iron mines of the Briey district of France during the war and manufactured some ferrovanadium. England

also produces a small quantity of this ferro alloy. More ferrovanadium, however, is manufactured in the United States than abroad.

IMPORTS AND EXPORTS.

As has already been noted, imports are small. From 1913 to 1919 practically no ferrovanadium was imported. In the calendar year 1919 imports amounted to 5.6 short tons (11,200 pounds). Table No. 41 shows the imports for consumption, with revenue collected, from 1911 to 1919, inclusive.

TABLE NO. 41.—*Imports for consumption of ferrovanadium and revenue collected, 1911–1919.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Tons.*				*Per cent.*
1911	20 per cent	1	$2,231	$446	$2,231.00	20
1912	do	.07	392	78	5,600.00	20
1913–1918		None.	None.			
Calendar year:		*Pounds.*				
1919	15 per cent	11,200	24,923	3,738	2.23	15

The exports of ferrovanadium are relatively large. In fact, the world largely depends upon the United States for its supply of this ferro alloy. The exports of ferrovanadium for the years 1911–1919 are shown in the following table:

TABLE NO. 42.—*Exports of ferrovanadium from 1911 to 1919, inclusive.*

(Fiscal years 1911–1918.)

Exported to—	1911 [1]		1912		1913	
	Pounds.		*Pounds.*		*Pounds.*	
Austria-Hungary	2,384	$1,500	5,913	$6,475	4,727	$3,488
Germany	22,875	28,047	90,257	88,428	267,496	198,871
Netherlands	25,641	42,346	73,406	74,853	42,895	33,923
Russia in Europe	2,372	3,100	2,388	3,321		
United Kingdom	54,146	96,918	114,934	135,906	243,325	205,041
Italy			1,180	1,700		
Dutch West Indies			6	6		
Canada					1,000	720
Total	107,418	168,911	288,184	310,719	559,443	442,037

Exported to—	1914		1915		1916	
	Pounds.		*Pounds.*		*Pounds.*	
Austria-Hungary	11,781	$10,159				
Denmark			11,798	$9,464		
France			14,428	10,902	172,267	$173,106
Germany	247,482	191,731	2,356	1,475		
Italy	3,526	2,420	35,277	28,219	28,378	22,926
Netherlands	2,621	1,998				
Norway			38,728	30,094	2,350	1,761
Russia in Europe	18,782	17,704	148,799	121,248	87,820	72,812
Sweden			81,980	75,715	35,135	31,248
United Kingdom	336,573	275,164	422,537	364,673	767,123	688,981
Canada	5,400	3,866			19,011	26,379
Costa Rica					40	39
Honduras			2	2		
Mexico					150	131
Dominican Republic					71	66
Colombia					40	35
Japan	476	347			541	495
Philippine Islands					150	137
Total	626,641	503,389	755,905	641,792	1,113,076	1,018,121

[1] *Not reported* previous to 1911.

TABLE No. 42.—*Exports of ferrovanadium from 1911 to 1919, inclusive*—Continued.

Exported to—	1917		1918		1918 (July–December.)		Calendar year 1919.	
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
France	430,304	$477,726	467,325	$603,120	89,600	$130,754	.....	.....
Germany	30,825	69,522	.....	.....	.....	.....	.....	.....
Italy	297,918	228,666	245,703	292,238	173,439	152,877	.....	.....
Russia in Europe	110,600	290,801	36,400	106,340	.....	.....	.....	.....
Sweden	551	424	.....	.....	.....	.....	.....	.....
United Kingdom	1,686,859	1,706,427	1,121,178	1,346,520	339,947	420,325	28,151	$14,856
Canada	38,315	35,383	206,003	211,130	19,711	37,944	32,117	67,350
Mexico	1	2	.....	.....	.....	.....	.....	.....
Newfoundland and Labrador	35	39	.....	.....	.....	.....	.....	.....
Dominican Republic	20	22	.....	.....	.....	.....	.....	.....
Japan	17,954	22,657	12,688	23,271	4,609	9,365	3,962	12,748
All other	.....	.....	50	51	.....	.....	396	606
Total	2,613,382	2,831,669	2,089,347	2,582,670	627,306	751,265	64,626	95,560

PRICES.

Ferrovanadium is one of the highest priced of the ferro-alloys. It is quoted per pound of contained vanadium. In December, 1916, it was quoted at $2.75 to $3 per pound, f. o. b. works. Since that time prices have risen. Table No. 43 shows the average monthly quotation in the United States for the years 1917 to 1920.

TABLE No. 43.—*Average monthly prices in the United States of ferrovanadium, per pound of contained vanadium, 1917–1920.*[1]

	1917	1918	1919	1920
January	$2.875	$3.50–$4.50	[2]	$5.50–$7.00
February	2.875	3.75– 4.75	[2]	5.50– 7.00
March	2.875	4.00– 5.00	[2]	6.30– 7.40
April	2.875	4.00– 5.00	$5.50–$7.00	6.50– 7.55
May	3.125	4.00– 5.00	5.50– 7.00	6.50– 7.75
June	3.375	[2]	5.75– 7.00	6.50– 7.75
July	3.375	[2]	5.50– 7.00	6.50– 7.75
August	3.375	[2]	5.50– 7.00	6.50– 7.75
September	3.375	[2]	5.50– 7.00	6.50– 7.75
October	3.375	[2]	5.50– 7.00	6.50– 8.31
November	3.375	[2]	5.50– 7.00	6.50– 8.25
December	3.375	[2]	5.50– 7.00	6.50– 7.50
Average	3.19	[3] 4.35	[4] 6.26	6.98

[1] Quotations from Chemical and Metallurgical Engineering.
[2] No quotations.
[3] Average for 5 months.
[4] Average for 9 months.

English prices on the whole are higher than those in the United States. In the following table the average monthly quotation for ferrovanadium (35–40 per cent vanadium) at the Sheffield Steel Works, England, are given for the year ending June 30, 1920:

TABLE NO. 44.—*English prices of ferrovanadium (35–40 per cent Va.) at Sheffield Steel works for year ending June 30, 1920, per pound of vanadium.*[1]

	English currency.			American currency.	
				At normal rate of exchange.	At current rate of exchange.
1919.	£	s.	d.		
July	1	6	0	$6.33	$4.72
August	1	6	2	6.37	4.75
September	1	6	6	6.45	4.78
October	1	7	1¼	6.59	5.65
November	1	10	3	7.36	6.17
December	1	11	10½	7.52	6.15
1920.					
January	1	15	0	8.52	6.67
February	2	9	7	12.06	8.58
March	2	15	0	13.38	10.01
April	2	15	10	13.59	11.02
May	2	19	0	14.36	11.83
June	3	1	6	14.96	12.15

[1] Quotations taken from the Iron and Coal Trades Review (London).

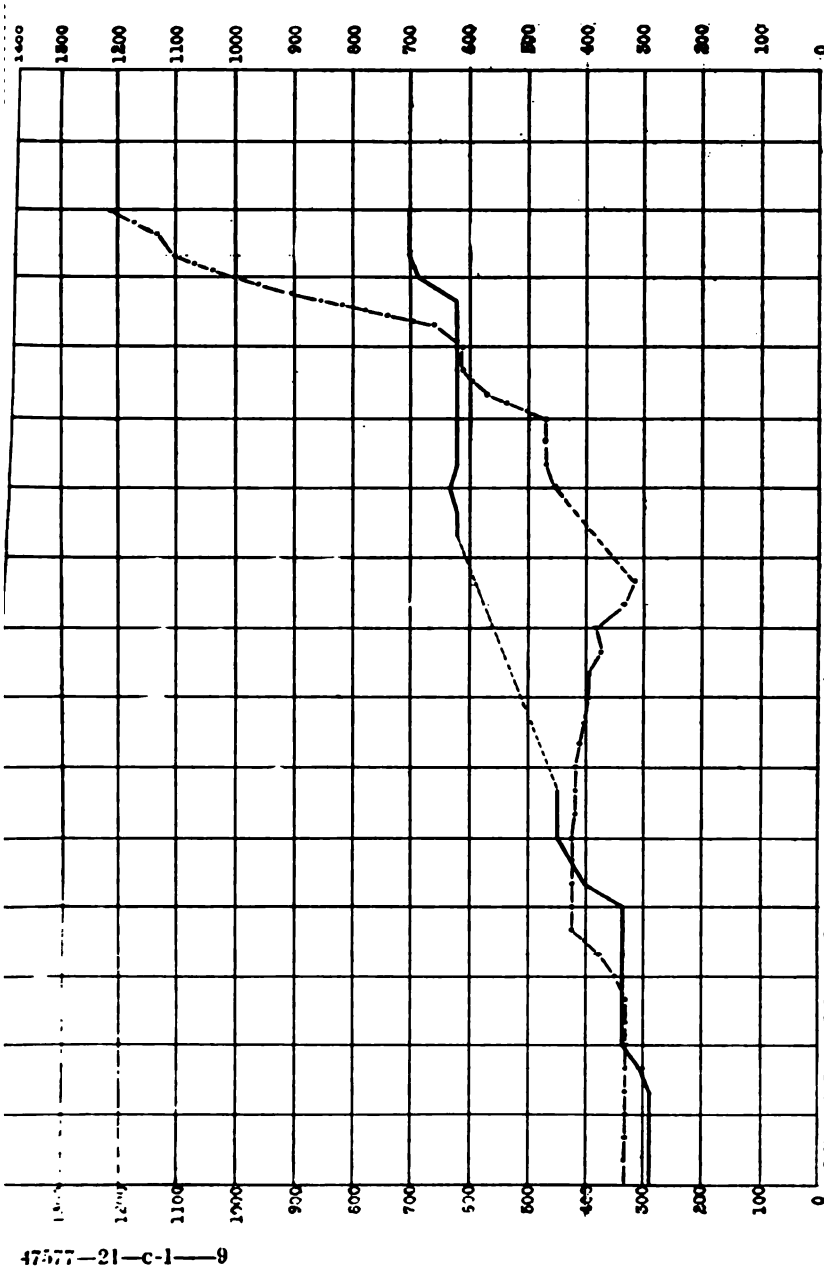
It will be observed that during the year for which quotations are tabulated prices were rising rapidly in England. In July, 1919, they were below those of the United States at the then current rate of exchange, but in June, 1920, they were very much higher.

COMPETITIVE CONDITIONS.

Ferrovanadium, as already noted, is one of the most expensive of the ferroalloys, and the greater part of this cost is due to the high value of the metal in the concentrate. A large part of this raw material is imported from South America, which furnishes the greater part of the vanadium ores of the world. These South American deposits are owned by American interests, and the ore in the form of concentrate is shipped for the most part to this country. While a small amount of ferrovanadium has at times been imported, the United States has practically speaking no competitor. Unless large ore deposits are discovered in other parts of the world this country seems unlikely to have any in the near future.

TARIFF CONSIDERATIONS.

Under present (1920) conditions no tariff problem arises with reference to the manufacture of ferrovanadium. This country furnishes most of the ferrovanadium produced in the world and controls the principal sources of supply of raw material. The imports of ferrovanadium having been very small and sporadic, the imposition of a duty yields only a negligible revenue.



British prices since 1915 are on the basis of the current rates of exchange.

MOLYBDENUM AND FERROMOLYBDENUM

DESCRIPTION.

Molybdenum is a heavy, white, malleable, tenacious metal, softer than steel and having an exceptionally high melting point. Ferromolybdenum is an alloy of molybdenum and iron and used as a source of molybdenum in making molybdenum steel. The pure metal was used to a considerable extent during the war, but the prevailing practice is to reduce the metal to the form of a ferroalloy.

The standard grade of ferromolybdenum is not well established. The molybdenum content generally varies from 50 to 80 per cent. Some manufacturers keep the carbon content of their product under 1 per cent, but others sell an alloy containing as much as 3 per cent carbon. Few consumers will accept ferromolybdenum with more than 0.1 per cent sulphur.

Uses.—The use of molybdenum in steel manufacture is in its infancy. During the war, with the soaring prices of tungsten, attempts were made to use molybdenum as a substitute in the manufacture of high-speed tool steel, but these attempts proved disappointing. Molybdenum metal has also been used in the production of stellite, both alone and in conjunction with tungsten. As much as 22 per cent molybdenum has been employed in special grades of this material.

As a steel alloy molybdenum raises the elasticity and tensile strength of steel and gives it greater toughness. The addition of as little as 0.25 per cent greatly increases elongation. It is claimed by some producers that molybdenum is superior to vanadium in making steel subject to repeated stresses and strains. Molybdenum steel containing 1 per cent or less molybdenum has been used by automobile manufacturers for rear-axle and crank-shaft material.

There has been much prejudice among American steel workers against the use of molybdenum, and as a result much of the molybdenite produced in this country is marketed abroad rather than manufactured into an alloy for use here. This prejudice seems now (1920) to be dying.

RAW MATERIAL.

The purest molybdenum is made from wulfenite (lead molybdate). The supply of this mineral is very limited, and hence practically all the world's output of molybdenum and ferromolybdenum is derived from molybdenite (molybdenum sulphide).

Prior to the war most of the molybdenite produced came from small and scattered deposits in Australia, Norway, Sweden, and the United States. After the outbreak of hostilities, however, large deposits were discovered in Colorado and new properties were opened up in other western States.

The United States became the world's greatest producer of this raw material.

PROCESS OF PRODUCTION.

Before the introduction of the electric furnace ferromolybdenum was made in crucibles from roasted molybdenite. It is now made in electric furnaces directly from raw sulphide, although roasted material is also used. Ferromolybdenum containing 80 per cent molybdenum and under 1 per cent carbon can not be regularly tapped from the electric furnace because of its high melting point. When this grade is made the furnace must be of the knockdown variety for removal of the button of metal.

The pure metal can be obtained in the form of a gray powder by reduction of roasted molybdenite in hydrogen. Under pressure and heat this powder can be compacted into a brittle metallic bar at a lower temperature than the melting point of the metal.

RECOVERY.

The recovery of molybdenum from molybdenite in the manufacture of the alloy is about 78 to 80 per cent. In the production of alloy steel the loss is small. Not far from 95 per cent of the metal in the ferro is recovered.

COUNTRIES OF LARGEST PRODUCTION.

Published statistics regarding foreign production are unavailable, or very fragmentary. In 1917 the two leading producers in Canada had an output of 149,000 pounds (74½ short tons) of ferromolybdenum, valued at $348,775. This probably represented the bulk of the production in Canada. On the basis of the output of the mines of the United States, Australia, Norway, Canada, Spain, and Peru, the world's production of molybdenum metal in 1915 would be about 222.6 tons. During 1916 and 1917 the world's output fully doubled, and hence the Canadian production for the latter of these years would be roughly 17 per cent of the world's total.

Production in the United States increased during the war, particularly after the opening up of the mines in Colorado and other western States. In 1918 a new concentrating plant at Climax, Colo., began operating, and its productive capacity is equal to 60 per cent of the world's output in 1915. The concentrated molybdenite, however, is sent to Niagara Falls, N. Y., to be manufactured into ferromolybdenum. Other plants for the production of molybdenum and ferromolybdenum exist in Pennsylvania.

CONSUMPTION.

The domestic consumption of molybdenum and ferromolybdenum has not been large. From 10 to 20 tons a year have answered the home requirements until recently. From 1914 to 1918 imports were negligible, but there were some exports, the figures of which are not published. During the latter half of 1918 and the first half of 1919 imports were considerable, indicating an increased home demand for molybdenum, and for the time being a consumption exceeding production. The falling off in imports during the latter half of 1919 indicates a return to the normal condition where production equals or exceeds consumption.

IMPORTS AND EXPORTS.

Figures regarding exports are not separately published. Be 1914 practically no molybdenum was exported, but later there more or less of this metal exported, mostly in the form of molybde concentrate, but still an appreciable amount as metal or ferro. latter, in Government publications, is included with "All other me and metal compositions."

Imports were small during the years from 1915 to 1918. Lat 1918 they increased rapidly and were relatively large during the f half of the calendar year 1919. Imports fell off greatly during latter part of 1919. The following table shows the imports of mol denum and ferromolybdenum, with the revenue collected for the y 1910 to 1919, inclusive:

TABLE NO. 45.—*Imports for consumption of molybdenum and ferromolybdenum, revenue collected for years 1910–1919.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actua compu ad val rat
Fiscal years:		*Tons.*				*Per c*
1910	20 per cent	9	$13,317.00	$2,663.00	$1,479.67	
1911	do	8	11,373.00	2,274.00	1,414.55	
1912	do	7	10,604.00	2,120.00	1,514.86	
1913	do	7	15,939.00	3,187.00	2,277.00	
1914	15 per cent		59.00	8.00		
1916	do		203.00	30.00		
1918	do	1	2,768.00	415.00	2,768.00	
		Pounds.				
1918 (6 months)	do	70,685	16,512.00	2,476.80	.23	
Calendar year:						
1919	do	102,700	40,759.00	6,113.85	.39	

PRICES.

The price of ferromolybdenum is quoted by the pound of molyb num contained. Before the war quotations in this country were v fragmentary. During November and December, 1916, they ran from $3.65 to $4 per pound of contained molybdenum. During year 1917 they gradually rose from $4 to $5 per pound, averaging the year between $4.10 and $4.25. The monthly averages for 19 1919, and 1920 are shown in the following table:

TABLE NO. 46.—*Average prices of ferromolybdenum per pound of contained molybden 1918–1920.*[1]

Months.	1918	1919	1920
January	$5.00	$3.50–$4.50	$3.00–
February	5.00	3.50– 4.50	3.00–
March	5.00	3.50– 4.50	2.35–
April	5.00	3.25– 4.00	2.25–
May	5.00	2.60– 3.00	2.25–
June	5.00	2.50– 3.00	2.25–
July	5.00	2.00– 3.00	2.50–
August	4.50	1.85– 2.00	2.31–
September	$4.00– 4.50	2.20– 2.50	2.25–
October	4.00– 4.50	2.50– 3.00	2.13–
November	3.50– 4.50	2.50– 3.00	2.00–
December	3.50– 4.50	3.00– 3.50	2.00–

[1] Quotations from Chemical and Metallurgical Engineering. Prices all f. o. b. works.

Foreign prices were rarely quoted before the war, and then at only infrequent intervals. Prices during the war were more or less influenced by Government regulation. In the following table English quotations per month, with their American equivalents at the normal and current rates of exchange, are given for the year ending June 30, 1920. American prices for the same period are added for comparison.

TABLE NO. 47.—*British prices of ferromolybdenum per pound of contained molybdenum compared with American prices, July, 1919–June, 1920.*[1]

Months.	British prices.			American prices.
	English currency.	American currency.		
		At normal rate of exchange.	At current rate of exchange.	
1919.	s. d.			
July	11 0	$2.68	$2.00	$2.00–$3.00
August	9 6	2.31	1.70	1.85– 2.00
September	9 6	2.31	1.70	2.20– 2.50
October	9 2½	2.24	1.93	2.50– 3.00
November	9 0	2.19	1.85	2.50– 3.00
December	9 0	2.19	1.74	3.00– 3.50
1920.				
January	9 1	2.21	1.72	3.00– 3.50
February	9 1	2.21	1.57	3.00– 3.50
March	11 5	2.78	2.08	2.35– 2.75
April	12 0	2.92	2.37	2.25– 2.75
May	11 3	2.74	2.16	2.25– 2.75
June	10 10	2.64	2.14	2.25– 2.75

[1] British prices are quoted from the Iron and Coal Trades Review (London) and are for ferromolybdenum with a molybdenum content 70–80 per cent at Sheffield Steel Works, England.

The prices range lower than those prevailing in the United States. Under normal conditions prices in this country would be somewhat lower than those abroad.

COMPETITIVE CONDITIONS.

The cost of producing molybdenum and ferromolybdenum is high, but the greater part of this expense is the cost of the metal in ore concentrate. As in the case of ferrotungsten, the item of raw material constitutes the bulk of the total cost. At present no country is so favorably situated with reference to raw material as the United States.

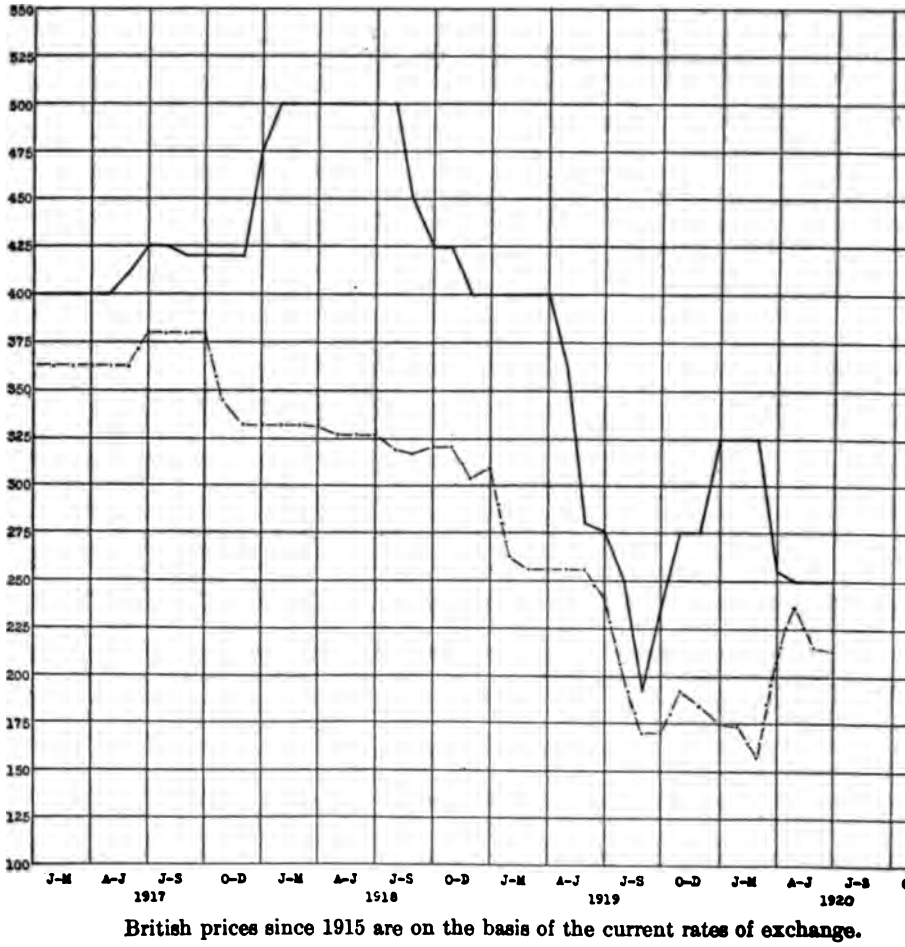
The price of electric power is an important item in the conversion cost; but, as in the case of ferrotungsten, the expense of conversion is a relatively small part of the total cost. With reference to this power cost, however, the American producer of ferromolybdenum has the same handicaps that the manufacturers of other electric-furnace ferroalloys have.

Some molybdenum and ferromolybdenum have been imported into this country during recent years, but most of it came as a result of the stocks left over in other countries after the war. The importation before the war, as has already been seen, was prior to the discovery of the large deposits in Colorado and other Western States. To-day the American industry is not seriously threatened with competition from abroad.

CHART No. 6.—UNITED STATES AND BRITISH PRICES OF FERRO-MOLYBDENUM (PER POUND OF MOLYBDENUM) FROM JANUARY, 1917, TO JUNE, 1920, INCLUSIVE.

[Cents per pound.]

United States quotations ————————————
British home quotations —.—.—.—.—.—.—.—.—.—.—



British prices since 1915 are on the basis of the current rates of exchange.

TARIFF CONSIDERATIONS.

Under present conditions there are no tariff problems connected with the manufacture of molybdenum and ferromolybdenum. Aside from the question of tariff classification, as it pertains to the ferroalloys in general, no problem arises with reference to grades or character of tariff rates. The competitive situation favors the American producer. As imports are small and sporadic, little revenue would be derived from any duty on this metal.

The question of compensatory duties is not likely to arise, as the supply of molybdenite from domestic sources is so large that a duty on this ore would not influence prices in this country. Prices of metallic molybdenum and ferromolybdenum to steel manufacturers would not be raised by virtue of any duty on the alloy for practically the same reason. Assuming no monopoly conditions, domestic producers are in a position to satisfy the home demand for metal and alloy at prices at least as low as those prevailing elsewhere in the world.

FERROTITANIUM.

DESCRIPTION.

Titanium is abundant in nature, but has not had extensive application in its metallic state because of its infusibility. The chief application is in steel manufacture where it is used in the form of a ferroalloy which contains from 15 to 25 per cent titanium. In addition to ferrotitanium alloys with copper, manganese, and other metals are made for use as deoxidizers for the production of sound castings of these metals as well as of steel.

The two most prominent alloys of titanium on the market and the only ones of domestic manufacture are ferro-carbon-titanium and carbon-free ferrotitanium. The former contains from 15 to 18 per cent titanium and the latter about 25 per cent titanium. The latter, while practically free from carbon, has considerable aluminum. Typical analyses of the two forms of this ferro-alloy are the following:

	Ferro-carbon-titanium.	Carbon-free-ferro-titanium.		Ferro-carbon-titanium.	Carbon-free-ferro-titanium.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Titanium	15.79	25.28	Manganese	0.11	.....
Carbon	7.46	(1)	Phosphorus	.05	.....
Aluminum	.80	4.88	Sulphur	.08	.....
Silicon	1.41	1.26	Iron	74.30	(2)

[1] Technically free. [2] Balance.

Uses.—Ferrotitanium in both these forms is employed simply as a deoxidizer. It is not an alloying agency. It is used to a great extent in the manufacture of rail tires and in plates and sheets. It is also employed in the treatment of steel rails made by the Bessemer process. It is a refining agent, and is effective not only for the removal of oxygen but also of nitrogen from steel. The latter function is very important. The consumption of titanium in rail manufacture has fallen off greatly because of the substitution of the open hearth for the Bessemer process in this industry. On the other hand, titanium has found a much larger use in the making of sheet steel since steel previously treated with titanium has proved better suited for galvanizing than any other type of steel, as less zinc and chemicals are required.

With respect to the merits of the two kinds of ferrotitanium opinions differ, but the value of this ferroalloy as a powerful cleanser of steel is recognized.

RAW MATERIAL.

Ferrotitanium is made from ructile (titanium dioxide), ilmenite (iron-titanium dioxide), or titaniferous iron ores (magnetites).

Titaniferous iron ore was formerly imported chiefly from Canada. In 1917 production increased in the United States, and the home

demand was met by the domestic supply. Large deposits exist at Lake Sanford, N. Y., and at Iron Mountain, Wyo. Considerable ore is also found widely distributed throughout the Eastern States and in Minnesota and Colorado.

Ructile has been obtained for many years from Virginia, where the American Ructile Co. operates, and from Norway.

Ilmenite and ructile have now been saved by special treatment from Florida beach sands. This Florida supply is now the most important source of titanium for American production.

Other raw materials are steel scrap and carbon, the latter being the reducing agent.

The raw material is relatively cheap and constitutes only about 15 per cent of the total cost of producing ferro-carbon-titanium and a smaller percentage of the expense of manufacturing the carbon-free product.

METHODS OF PRODUCTION.

Ferro-carbon-titanium is made in the electric furnace. A higher temperature is reached in the manufacture of this ferroalloy than in that of any other. The carbon-free alloy is made by the thermit process, where powdered aluminum is used as a reducing agent. Pure titanium is also produced from ructile by a modification of the thermit process.

GEOGRAPHICAL DISTRIBUTION AND ORGANIZATION.

There are only two companies which regularly manufacture ferro-titanium in the United States, the Titanium Alloys Manufacturing Co., which operates a large plant at Niagara Falls, and the Metal & Thermit Corporation, whose plant is located in Jersey City, N. J. The former manufactures all kinds of titanium products, while the latter makes the carbon-free alloy as a part of its more extensive business in other lines.

DOMESTIC PRODUCTION AND CONSUMPTION.

As the output of the country is confined to two producers, the figures of production are not separately published. Consumption and production are nearly equal. Some titanium and ferrotitanium are imported and some exported, exports on the whole exceeding imports.

FOREIGN PRODUCTION.

No statistics concerning foreign output are available. Before the war ferrotitanium was made by 15 manufacturers in Germany, 3 in Great Britain, and 2 in France. Switzerland and Sweden were also producers.

IMPORTS AND EXPORTS.

The imports of titanium and ferrotitanium are small and sporadic. No separate figures are published concerning exports, but an appreciable amount of these products are sent abroad. The exports consist mainly of ferro-carbon-titanium, while the high value per unit

of the imports would seem to indicate that these are the carbon-free product. The following table shows the imports for consumption for the years 1914–1919:

TABLE NO. 48.—*Imports for consumption of titanium and ferrotitanium and revenue collected, 1914–1919.*

	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Tons.*				*Per cent.*
1914	15 per cent	12	$5,618	$842.00	$468.17	15
1915	do	6	2,738	410.00	456.33	15
1917	do	100	8,126	1,218.00	81.26	15
1918	do					
		Pounds.				
[1] 1918(6 months)	do	10	10	1.50	1.00	15
Calendar year:						
1919	do	12,000	3,317	497.55	.28	15

[1] July 1 to Dec. 30, 1918.

PRICES.

Ferro-carbon-titanium is sold by the net ton, and sales are made direct to steel companies. Ferro-carbon-titanium sold early in 1918 at $160 per ton of 15 to 18 per cent alloy, f. o. b. Niagara Falls, in carload lots. In April the price advanced to $200, and at the end of the year the quotation was $200 to $250 per ton, depending upon the size of the order. In April, 1920, the price was $200 per ton.

Carbon-free ferrotitanium is sold by the pound of contained titanium, and is much more expensive than ferro-carbon-titanium. In the spring of 1920 it was selling at 40 cents per pound of contained metal. British quotations per pound of contained titanium, 23–25 per cent grade, for the year ending June 30, 1920, are shown in the following table:

TABLE NO. 49.—*Prices of carbon-free ferrotitanium per pound of contained titanium at Sheffield Steel Works, England, July, 1919–June, 1920.*[1]

	British currency.	American currency.	
		At the normal rate of exchange.	At the current rate of exchange.
1919.	*s. d.*		
July	1 5	$0.35	$0.26
August	1 5	.35	.26
September	1 5	.35	.26
October	1 5½	.36	.31
November	1 6	.37	.31
December	1 6	.37	.20
1920.			
January	1 6	.37	.28
February	1 6	.37	.26
March	1 6	.37	.27
April	1 9	.43	.35
May	1 10	.45	.35
June	1 10	.45	.36

[1] Quotations from Iron and Coal Trades Review (London).

At the normal rate of foreign exchange the prices above quoted are early the same as those prevailing in the United States. At the urrent rates they are somewhat below those of this country.

COMPETITIVE CONDITIONS.

The imports of ferrotitanium are small, both absolutely and in proportion to domestic output. There is at present (1920) no serious competition from abroad in the domestic market.

The United States is favorably situated with respect to the supply of ore from Canada, and is itself well endowed with this raw material. The cost of titaniferous ores, however, constitutes a relatively small percentage of the total expense of manufacture. In the production of ferro-carbon-titanium, which is made in the electric furnace, the consumption of power is great and constitutes a large element in the total cost. The relative prices of power in the several countries manufacturing ferro-carbon-titanium are an important factor in determining the competitive strength of the producers in these countries. As hydroelectric power is more expensive in the United States than in some foreign countries, this higher cost may be a serious handicap to the American producer in the event of future competition from abroad.

TARIFF CONSIDERATIONS.

With the present small and sporadic importation of ferrotitanium, he tariff problem is not an urgent one, either because of adverse ompetitive conditions or on account of revenue possibilities. In ariff classification, however, recognition should be given to the fact hat the carbon-free ferrotitanium is a much more expensive product han ferro-carbon-titanium, and is produced under different condiions. The possibility of serious foreign competition in the future on ccount of high power costs merits some consideration.

FERROPHOSPHORUS.

DESCRIPTION.

Ferrophosphorus is a chemical combination of iron and phosphorus with smaller amounts of other ingredients. Two grades of ferro-phosphorus are used, one containing a phosphorus content of 16 to 2 per cent, and the other, a phosphorus content of 20 to 25 per cent. The following are typical analyses of these two grades:

	16 to 20 per cent phos-phorus.	20 to 25 per cent phos-phorus.		16 to 20 per cent phos-phorus.	20 to 2 per cent phos-phorus.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Phosphorus	17.5	24.0	Carbon	0.27	0.
Iron	76.2	73.3	Manganese	5.75	.
Silicon	.42	2.47	Sulphur		.

Uses.—The principal use of ferrophosphorus is to bring the phosphorus content of sheet bars from the open-hearth limit of about 0.025 per cent to the Bessemer limit which is about 0.10. With the phosphorus at the Bessemer limit, tin plate and sheet manufacturers, to whom sheet bars are raw material, find that the stripping or tearing apart of the plates or sheets can be accomplished with the minimum loss. Sheets with a higher phosphorus content also pickle cleaner.

Ferrophosphorus is also employed to bring the phosphorus content of the open-hearth steel in pipe and screw stocks up to the Bessemer limit. It is claimed that the tensile strength of pipe steel is increased and its welding quality improved by the higher phosphorus content. Screw stock steel becomes more uniform and the threads cleaner-cut in the finished product with this addition of phosphorus.

RAW MATERIAL AND PROCESS OF MANUFACTURE.

The raw material of this ferro-alloy is apatite, or other phosphorus-bearing mineral, and scrap iron or steel. This raw material does not constitute a very large item in the total cost of production. Where the blast-furnace method is employed, coal or coke is used in large quantity as a fuel and is an important item in cost.

Ferrophosphorus is produced both in blast and electric furnaces. In the United States the greater part is made by the blast-furnace method. In recent years some electric furnace ferrophosphorus has been manufactured.

GEOGRAPHICAL DISTRIBUTION, PRODUCTION, AND CONSUMPTION.

Ferrophosphorus is manufactured in blast furnaces at Rockdale, Tenn., and in electric furnaces at Anniston, Ala. The country's output of ferrophosphorus during the eight years from 1912 to 1919, inclusive, averaged considerably over 7,000 gross tons per annum. The Geological Survey reported for 1916 sales of this ferro-alloy produced in the United States amounting to 12,968 gross tons. The consumption of ferrophosphorus is approximately the same as the production. Imports are small compared with production and exports are negligible.

FOREIGN PRODUCTION AND IMPORTS.

Statistics regarding foreign output are lacking. Ferrophosphorus is manufactured in Germany, and before the war the imported supply in the United States came from that country. The German ferrophosphorus was made in electric furnaces. Some electric furnace ferrophosphorus is also made in Canada.

During the years 1910 to 1919, inclusive, imports reached their climax in 1911 when 195 tons were imported.

In the calendar year 1919 imports aggregated 76 tons. The figures for imports and revenue are tabulated as follows:

TABLE No. 50.—*Imports for consumption of ferrophosphorus and revenue collected, 1910–1919.*

	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Tons.*				*Per cent.*
1910	25 per cent	135	$6,535	$1,633	$48.41	25
1911	do	195	6,866	1,716	35.09	25
1912	do	127	6,446	1,611	50.50	25
1913	do	81	3,689	922	45.33	25
1914	15 per cent	26	1,136	170	44.00	15
1915	do	27	1,213	181	44.93	15
1916	do	12	617	92	51.42	15
1917	do	85	5,458	818	64.21	15
1918	do	10	1,055	158	105.50	15
Calendar year:		*Pounds.*				
1919	do	170,806	5,846	876.90	.034	15

PRICES.

The price of ferrophosphorus is quoted by the ton.[1] In 1919 this ferro-alloy was selling at $125 per ton at furnace in the United States English quotations by the month during the second half of 1919 and the first half of 1920 are as follows:

TABLE No. 51.—*Prices per gross ton of ferrophosphorus at the Sheffield Steel Works, England, July, 1919–June, 1920.*

Months.	British currency.	American currency.	
		At the normal rate of exchange.	At current rate of exchange.
1919.	£. s. d.		
July	18 0 0	$87.60	$65.34
August	18 0 0	87.60	65.34
September	.. .. ..	.....	.....
October	14 10 0	70.56	60.76
November	14 15 0	71.78	60.48
December	16 10 0	80.30	61.76
1920.			
January	24 7 6	118.62	92.14
February	48 0 0	233.59	166.06
March	52 10 0	255.49	191.10
April	52 10 0	255.49	237.38
May	52 10 0	255.49	201.60
June	52 10 0	255.49	207.38

[1] Very few quotations for ferrophosphorus are published.

In 1919 ferrophosphorus was selling in England at a lower pri than in the United States. Prices increased in England in 1920 a in the spring of that year were much higher than in this country.

COMPETITIVE CONDITIONS.

The imports of ferrophosphorus have been small in proportion domestic production. As this ferroalloy is low in price compar with its bulk, the cost of transportation is an important item in i cost in regions remote from its place of production. Small differenc in price therefore are not likely to result in any marked increase importation.

In the manufacture of ferrophosphorus by blast furnace the pri of coke is a large element in total cost. As coke is as cheap this country as anywhere else in the world, the American producer at no disadvantage compared with his foreign competitor. Whe ferrophosphorus is made in electric furnaces the situation of t American producer with reference to his foreign competitor is mu like that of the manufacturer of standard grade ferrosilicon or ferr chrome. However, unless prices are high, blast-furnace producti is the only economical and profitable method in this country, and th method is apparently as cheap as the electric-furnace process abroa Where the electric furnace has been used in this country it has be due to the utilization of electric power formerly employed in tl production of other ferro-alloys.

TARIFF CONSIDERATIONS.

There is no special problem with reference to tariff classificatio or kind of duty to be imposed. The competitive position of th domestic producers is not seriously menaced by any known speci advantages which the foreign manufacturer may have. Whi hydroelectric power is cheaper in some foreign countries than in th United States, the blast-furnace ferrophosphorus made in th country, as shown by the small importation, has been able to hold i own against the foreign product. Certain radical alterations in th relative prices of coke and hydroelectric power may, of course, chan this situation.

The importation of ferrophosphorus has been too small to yield ar considerable revenue. Since 1912 the duties collected on imports any one year never amounted to as much as $1,000. In 1911, und a 25 per cent ad valorem rate, the duties collected on the unusual large importation of 195 tons amounted to only $1716.

MINOR FERRO-ALLOYS.

Among the alloys of iron with the rarer metals are several which are produced in very limited amounts and whose manufacture and use are still in an experimental stage. The alloys of this character treated in this report are ferrouranium, ferroboron, ferroaluminum, ferrozirconium, and ferrocerium. These ferro-alloys are used in steel manufacture mainly as a means by which a small percentage of the rarer metal may be added to the steel for strengthening it or adding certain qualities essential to the purpose for which the steel is used. One of these alloys—ferroaluminum—is no longer manufactured, as the pure aluminum can be obtained and used more cheaply than the ferro. There are, however, indications of a possible revival of production of ferroaluminum. Ferrocerium is a pyrophoric alloy, and hence has a use quite different from the other ferro-alloys treated in this report.

FERROURANIUM.

Uranium is a heavy and extremely active element. It is found very rarely as a black oxide, pitchblende, the mineral in which radium was first discovered, but more abundantly in the Colorado radium ore, a bright yellow oxide and silicate of vanadium, uranium and lime. After the radium and vanadium are extracted the uranium remains as a by-product, usually as a soda-uranium compound. This is treated so that a uranium oxide is obtained, which is reduced by carbon in an electric furnace in the presence of iron ore or scrap. The uranium content of this ferroalloy as manufactured in the United States ranges from 25 to 35 per cent.[1]

The uranium in this product is used as an alloy. The influence of uranium on steel is not completely known. It has been claimed that it has great strengthening power and renders steel resistant to shock. It is also urged in behalf of its use that it gives steel both hardness and toughness, performing the functions of both chromium and vanadium when used as alloys. On the other hand steel manufacturers find that ferrouranium oxidizes very readily and are therefore averse to making much use of it.

The raw material of ferrouranium, uranium oxide, is derived from Colorado ore. In 1918 this material sold at $3.25 to $3.60 per pound, and uranium ore (carnotite) at $3 per pound of U_3O_8 contained, for 2 per cent minimum. No raw material is imported.

Ferrouranium is a high-priced alloy. It is quoted by the pound of contained uranium. In 1917 and 1918 it was quoted at $7 to $7.50 per pound of uranium. In 1919 and 1920 it has been quoted at $7 per pound.

The manufacture of ferrouranium in the United States is confined to one plant, located at Canonsburg, Pa.

[1] In Chemical and Metallurgical Engineering the uranium content is given as 35 to 50 per cent. This, however, is a mistake.

FERROZIRCONIUM.

Ferrozirconium, as now offered to the trade, carries approximately 30 to 40 per cent zirconium metal and sells for about $4 per pound of metal contained, depending upon the quantity demanded.[4] In England a 20 per cent ferrozirconium has been used in limited measure in place of ferrotitanium in scavenging steel.

The possibilities of ferrozirconium as an element in steel was much exploited during the war. It was reported that zirconium-bearing steels are adapted for bullet-proof sheets, armor-plate, and armor-piercing projectiles.[5] Prior to the entry of the United States into the war it was rumored that the Germans had developed remarkable zirconium steel which was said to be superior to vanadium, molybdenum, tungsten or nickel steel. The demand for light armor plate on tanks, aeroplanes and other equipment led the Government to investigate the possibilities of steel-hardening elements for such purposes, and it was decided that zirconium was best suited for the requirements of the War Department.[4] Both ferrozirconium and ferrochromium zirconium were made in small lots in the United States in 1918.[5] A common saying was that the use of ferrozirconium would make steel one-half inch thick as potent as ordinary armor plate 1¼ inch thick.

Later experiments cast doubt upon the value of zirconium for some of the purposes above indicated. It is held that zirconium light armor steel has proved a failure. The Bureau of Standards says that zirconium in steel up to 1 per cent has little effect, good or bad.

FERROCERIUM.

Ferrocerium is an alloy consisting of approximately 30 per cent iron and 70 per cent cerium, with lanthanum, didymium, and traces of other ingredients. It is employed as a tinder in pocket-cigar lighters, gas lighters, igniters for mine lamps, and during the war it found considerable application in the manufacture of hand-grenades and projectiles.[4]

The domestic production of this ferro alloy probably runs from 1,000 to 2,000 pounds per month. Prior to 1917 ferrocerium was manufactured under Austrian patents, but following the seizure of these patent rights by the Alien Custodian, licenses were granted to several American manufacturers to produce the metal.

The raw material from which the cerium is derived consists of monazite sand residues. Monazite sand is found rather plentifully in Brazil and India, and to some extent in North Carolina. The alloy is produced by electrolytic methods.[6]

The manufacture of ferrocerium is part of the pyrophoric-alloy industry which is engaged in the mining, separating, purifying, and using the earthy metals or salts of metals which at one time were considered rare, i. e., cerium, lantharum, didymium, yttrium, zirconium and thorium. This rare-earth industry was founded in 1855 by an Austrian, Baron Auer von Welsbach, who invented the incandescent gas mantle. About 1887 the industry took root in the United States with the organization of the Welsbach Light Co.

[4] Mineral Fleotnotes January–February, 1919, p. 9.
[5] Engineering and Mining Journal, Jan. 11, 1919, p. 85.
[6] Chemical and Metallurgical Engineering, Sept. 28, 1918, 510.

Experimentation soon showed the value of 1 or 2 per cent of the oxide of cerium in adding to the light emission of the mantle. Baron Auer von Welsbach further utilized cerium metals and developed the improvement of hardening the relatively soft cerium with iron to make hard metal which would emit sparks when scratched. He took out patents the world over. When Welsbach and his associates developed this pyrophoric-alloy business, they centralized the manufacture of cerium and the alloy in the Treibacher Chemische Gesellschaft, of Treibach, Austria (a part of the rare-earth cartel or trust), and established branches of this Austrian company in England, France, Russia, and the United States. It was not until after the outbreak of the war that a pound of cerium was made anywhere in the world outside of the Central Powers, except by the New Process Metals Co., of this country, which operates under the basic patent on metallic cerium. [7]

In April, 1917, the manager of the American branch of the Chemische Gesellschaft of Treibach gave notice that he was doing business under the name of the American Pyrophor Co., and from April to December of that year the New Process Metals Co. continued to furnish metallic cerium to the American Pyrophor Co. After the declaration of war against Austria the property of the latter company was taken over by the Alien Property Custodian of the United States.[8]

Ferrocerium while used primarily in the pyrophoric-alloy industry is useful as a desulphurizer in steel when employed up to 0.3 per cent.

Ferrocerium is the highest priced of the ferro-alloys. In 1917, while still manufactured under Austrian patents, the price was $25 per pound. In the spring of 1918 the market dropped to $18 or $20 for moderate-sized lots with slightly lower figures for large quantities under contract.[9]

TARIFF CONSIDERATIONS.

The production of the minor ferro-alloys is limited and to a very large extent in an experimental stage. Ferrocerium, as a pyrophoric alloy, has a well known and important use. Experiments, however, continue to be made to determine its other properties as an alloy of steel. Ferroaluminum, which is not now manufactured, is well known as a powerful deoxidizer, but its use is dependent upon a lower cost of production. The uses and value for steel-making purposes of ferrouranium, ferroboron, and ferrozirconium are still problematical.

Where experimentation is carried on to determine the uses and possible value of any metal or alloy, production is small and overhead charges relatively large. The cost of laboratory equipment and experiments enter largely into the total expense of manufacture. This item varies greatly with the product and the amount of output sold. While a variable element, it is a very tangible one in certain stages of industrial development.

The cost of raw material is also large in the case of these ferro-alloys, and with increased use will probably remain the most important item in the total expense of production. The ores or raw

[7] Chemical and Metallurgical Engineering, Sept. 28, 1918, pp. 510-511.
[8] Chemical and Metallurgical Engineering, Sept. 28, 1918, p. 512.
[9] Mineral Footnotes, January-February, 1919, p. 6.

ls used in their production are largely supplied from domestic
. Carnotite, from which uranium oxide used in the manu-
of ferrouranium is derived, is found mainly in Colorado.
nite, which contains lime and boron oxide and constitutes the
terial of ferroboron, is a California product. Bauxite for
minum—should the production of this alloy be revived—is
d in Arkansas, Georgia, Alabama, and other Southern States.
r materials entering into the manufacture of ferrozirconium
ocerium are derived mainly from Brazil. That country con-
e only known deposit of free zirconium oxide or zirconia and
t important one of monazite sand.
is country the minor ferro-alloys are mainly electric-furnace
s. The cost of electric power is an important element in the
on cost. Aside from overhead expense, including experi-
on, the conversion cost is not a large percentage of the total,
1 this percentage varies considerably with the alloy. If inter-
competition should become keen, however, it is large enough
e factor in the competitive situation, and the price of electric
s an important item in this conversion cost would be a deter-
element. As already noted in the discussion of ferrosilicon
ochrome, the price of hydroelectric power in the United States
than in some countries of Europe.

GENERAL CONSIDERATIONS

From the treatment of the several ferro-alloys above given be seen that the tariff problems vary with the product manufa and to some extent with the grade. There are some features of problems common to all or several of these alloys which are des of further attention both in the way of summarizing what has a been stated and in the way of elaboration. Among these are fication, competitive aspects, transportation, foreign exchang electric furnace production.

CLASSIFICATION.

All the products treated are ferro-alloys. While containin their uses sharply differentiate them from pig iron with whicl were once classified in our tariff laws and with which spiegeleis ferromanganese are still grouped in recent enactments. Ther reason why ferromanganese, for example, should be grouped wi iron and iron ore, as under the acts of 1909 and 1913, while ferro is put with another class of products. Ferromanganese as v ferrosilicon is a ferro-alloy rather than a kind of pig iron and s be treated as such.

Recognized as ferro-alloys, the fact that conditions of prod vary greatly and affect the competitive position of American facturers deserves consideration in the imposition of duties. two principal factors determining costs are source and charac raw material and method of production. With respect to th the price of raw material when imported is seriously affected l present foreign exchange situation and by ocean freights. regard to source of raw material, i. e., ore concentrate, the alloys may be broadly divided as follows:

Dependent wholly or mainly on domestic ores or materials.	Dependent wholly or mainly upon foreign ores or materials.
Spiegeleisen.	Ferromanganese.
Ferrosilicon.	Ferrochrome.
Ferromolybdenum.	Ferrotungsten.
Ferrotitanium.	Ferrovanadium.
Ferrophosphorus.	Ferrozirconium.
Ferrouranium.	Ferrocerium.
Ferroboron.	

As has been pointed out some domestic ores are used in th duction of ferromanganese, ferrochrome and ferrotungster these ores are either limited in amount or produced at consid greater expense than the foreign material. Ocean freight ra not seem to affect the prices to American manufacturers of tur bearing ores and probably chromite, but the foreign exchange tion affects both of these and manganese ores. The control vanadium ores by American interests having their furnaces country precludes any present question of the ability of the do producer to hold his own market.

With respect to the method of manufacture the competitive tion is very different when the electric furnace process is use

what it is when the blast furnace method obtains. A grouping of the ferro-alloys according to the process of manufacture most commonly used is as follows:

Blast furnace method.	Electric furnace method.	Aluminum process.
[illegible].	Ferrosilicon with silicon content 16 per cent and above.	Carbon-free ferrochrome.
[illegible].	Ferrochrome.	Carbon-free ferrotungsten.
[illegible] ferrosilicon (silicon content 6-15 per cent).	Ferrotungsten.	Carbon-free ferrovanadium.
Ferrophosphorus.	Ferrovanadium.	Carbon-free ferrotitanium.
	Ferrotitanium.	
	Ferrouranium.	
	Ferroboron.	
	Ferrozirconium.	
	Ferrocerium.	

The output of carbon-free alloys made by the aluminum process is very limited. There is a small—in fact, negligible—production of ferro-alloys in crucible furnaces. The processes employed are therefore mainly blast furnace and electric furnace. When the blast furnace process is used it is generally the cheapest of any; and blast-furnace costs, on account of the relatively low prices of coke in this country, are less here than in any other part of the world.

Some ferro-alloys usually made in blast furnaces are produced in limited amounts in electric furnaces. Ferromanganese, low-grade ferrosilicon (silicon content 15 per cent or less), and ferrophosphorus are illustrations.

The electric-furnace situation, as has been indicated, is very different from that of the blast furnace. The effect of the higher electric power cost in this country compared with that obtaining in some other countries varies, of course, with the relative importance of this cost in the total expense of manufacture.

In the case of the higher grades of ferrosilicon it is a determining factor, and in that of ferrochrome, important. When ferrotungsten, ferrouranium, ferrovanadium, and other high-priced alloys are considered, power costs, while a large item in the conversion expense, are greatly overshadowed by the value of the metal in the concentrate.

COMPETITIVE ASPECTS.

The competitive position of the American producer depends mainly upon two things, the cost of raw material and the price of electric power. To these two may be added labor cost, although this item is a smaller factor than the two mentioned. In a period of severe competition it might be a decisive influence in the case of a few of the electric furnace ferro-alloys, e. g., ferrosilicon and ferrochrome. In the case of the blast-furnace ferro-alloys, the higher wages in this country compared with those prevailing in Europe are offset, as has been pointed out, by larger furnaces and greater output per man employed. In the case of the high-priced ferro-alloys like ferrotungsten, labor cost forms such a small percentage of the total that its influence is not likely to be seriously felt. Where the ore costs are low the item of labor becomes relatively more important and thus more of a determining element. Some years before the war tungsten-bearing ores were purchased at low prices by German manufacturers of tungsten metal and ferrotungsten, and labor cost constituted a larger percentage of the total expense than at the present time in Europe or the United States. In Westphalia, where wages

were higher than in other parts of Germany, manufacturers were driven out of business by producers in Berlin and Saxony, where labor costs were lower. Under present conditions, however, labor cost is not a large enough item in the high-priced alloys to be a big factor.

For reasons already given the price of raw material, particularly ore, and the rates charged for electric power are decisive factors. In the case of all the alloys sold by the pound of contained metal and in the case of ferromanganese, which is sold by the ton, the ore cost is by far the largest item in the total expense of production. Where this ore is obtained from abroad the price at the plant of the manufacturer in the United States compared with the corresponding price abroad is a decisive factor in the competitive situation.

The cost of electric power is an appreciable item in the expense of manufacture of all alloys made in electric furnaces. Where, however, the cost of raw material does not constitute 70 or 80 per cent of the total expense as in the case of ferrotungsten, ferrovanadium, and other high-priced alloys, it is a more determining influence. In the case of ferrosilicon it is a large item, and in that of ferrochrome, an important one.

The competitive situation, however, is influenced by other factors. Ferrovanadium, for example, which is made largely in electric furnaces and for the most part from imported ores is not menaced at present by foreign competition because of American control of the vanadium ore deposits of South America. In some other lines where there is little or no foreign competition at present potential competition exists. The ferro-alloys may be divided with reference to present active competition into three groups according to its presence or absence or its classification with the minor ferroalloys in which competition is not yet a factor, as follows:

Subject to considerable active foreign competition.	Subject to little or no present foreign competition.	Minor ferro-alloys.
Ferromanganese. Electric-furnace ferrosilicon. Ferrochrome. Ferrotungsten.	Spiegeleisen. Blast-furnace ferrosilicon. Ferrovanadium. Ferromolybdenum. Ferrotitanium. Ferrophosphorus.	Ferrouranium. Ferroboron. Ferrozirconium. Ferrocerium.

The products now subject to active foreign competition, indicated in the first column, are produced in this country under some disadvantages connected with either high cost of raw material or high cost of electric power or both. Of those not subject to any considerable foreign competition the domestic producers of spiegeleisen, blast-furnace ferrosilicon, ferrovanadium, and ferromolybdenum are apparently secure under present industrial conditions. Very little ferrotitanium has been imported, but potential competition exists, as some other countries are well supplied with the raw material for this alloy and have cheaper water power than this country. The latter constitutes a large item in the manufacture of ferro-carbon-titanium. Some ferrophosphorus has been imported, but the amount has been small compared with the home production. Foreign competition of a formidable character in this line depends upon the relative cheapness of the blast-furnace and electric-furnace methods of produc-

tion. Should the latter method abroad become cheaper than the former method in the United States foreign ferrophosphorus in larger quantities may invade the American market. However, the cost of transportation is an appreciable element in the price of this alloy and the difference in costs of production at home and abroad must be sufficient to cause a movement of product.

In the case of the minor ferro-alloys, production is too limited or too experimental for any definite statement to be made concerning their competitive situation. The conversion cost of these products forms a small percentage of their total, but in this conversion cost the price of electric power constitutes a large percentage. The raw material of these alloys is expensive, but that of ferrouranium and ferroboron is of domestic origin. The raw material for ferrozirconium and ferrocerium is largely imported. Their limited output and their experimental nature tend to make overhead charges a relatively much larger item of expense than in the case of ferro-alloys whose production is greater and more standardized.

The carbon-free ferro-alloys are made in small quantities in this country. The aluminum process employed in this manufacture is a costly one but not more so in this country than abroad.

TRANSPORTATION.

Transportation affects the economic and competitive position of the American ferro-alloy manufacturers in three ways: (1) It may alter the relative costs of imported raw material at seaboard points in the countries producing these alloys; (2) it may alter the corresponding costs at the plants of consumers in these countries; and (3) it may determine the ability of the domestic producer to compete with his foreign rival in the domestic market.

(1) The first influence is the most important but the hardest to state with any degree of definiteness. The raw material of some of the most important and most widely used ferroalloys is imported, and the price which the American manufacturer pays is largely a matter of ocean freight rates. Charges on ocean liners are not so stable as on railroads; and on tramps they are usually fixed by individual bargaining. Under normal conditions line rates generally range higher than rates on chartered vessels or tramps. But during the war, on account of the scarcity of floating equipment which could be freely used for trade purposes, ocean tramps usually charged more than liners. Where such a condition prevails much difficulty is experienced in securing adequate supplies of raw material. Mention should also be made in this connection that on established ocean routes some freight often goes at very low rates as ballast. An instance in point is one which has already been mentioned, that of manganese ores shipped from India to England before the war.

It will be seen that even with a full knowledge of the rates prevailing between the different ports of the world at any one time it would be difficult to state with precision their effect on the prices of raw material at coastal points in the several producing countries. Roughly speaking, however, the freights on ocean liners are determined by distance of haul and volume of freight. The first may mean distance in the geographical sense or the distance involved in two or more hauls, as where there is no direct line from one country or colony to another and freight must thus be transhipped one or more times

before reaching port of destination. The volume of freight is an important factor where movement is heavy in one direction and light in the opposite. In order to increase the volume of freight in the latter direction exceptionally low rates may be offered shippers.

The application of these principles, so far as volume of freight carried between different countries is concerned, is impossible. Figures of exports and imports are not published according to routes and frequently not according to tonnage. Geographical situation, therefore, must be the basis of any surmise of transportation costs to the different seaports at which ores are received.

The three most important ferro-alloys where raw materials are affected by ocean freights are ferromanganese, ferrochrome, and ferrotungsten. With reference to tungsten-bearing ores which constitute the raw material for tungsten metal and ferrotungsten geographical conditions are as favorable to the American producer as to the British or other manufacturer. The cheapest ores come from China, and the ocean freights on Chinese ores are practically the same to our seaboard, Atlantic or Pacific, as to England, this country's principal competitor.

As has already been pointed out, the ocean freight on manganese ores is somewhat lower from India to England than from India to the United States. The difference is not great and is much less than in the period before the war. But it is sufficient to afford a tangible advantage to the English manufacturer of ferromanganese. The freight on Brazilian ore to the United States is reported to range from $8 to $12 per ton and is less than to England. Of late freights from Brazil to this country have been going down because of the large export tonnage of American goods to that country coupled with a comparatively scanty return tonnage. However, the Brazilian ore is mined at greater cost than the Indian ore and averages lower in manganese content.

On the other hand, manganese ores from the Black Sea region are carried to the United States at an average rate of $8 per ton, while to England the rate is £3, which at the current rate of exchange is approximately $10.50. This differential at the present time is of little or no practical advantage to the American producer of ferromanganese, as the amount of ore shipped is negligible. With the revival of trade, however, this differential if continued will be of great advantage to the producer in this country. The geographical position, however, of the Caucasian region from which this ore has been shipped in the past is, on the whole, more favorable to the British than to the American manufacturer. The resumption of trade with this region is likely to result in an alteration in the relative rates to England and the United States.

A large part of the imported chromite used in the manufacture of ferrochrome comes from New Caledonia. Much of this ore is sent to Australia and then reshipped to this country. Transportation cost on a direct route through the Panama Canal to New York City is as cheap as to France or England and cheaper to San Francisco than to any of these places. It has been difficult to get any definite data on ocean freight rates on New Caledonian ores, as they are apparently subject to considerable fluctuation. Traders and manufacturers in this country are of the opinion that this ore can be laid down at New York as cheaply as in France or England.

According to figures secured by the Tariff Commission, Rhodesian chromite is landed at Philadelphia and at Liverpool, England, at the same rate, £2 5s. per ton. There is, however, evidence that much Rhodesian chromite is carried in tramp vessels to northwestern Europe at very low rates as ballast.

(2) Most of the furnaces manufacturing ferroalloys in the United States are located some distance inland. This location means an appreciable addition to the cost of the imported material at the seaboard. In the case of the high-priced concentrates like tungsten-bearing ores, this added cost is not seriously felt by the producer. Manganese ore, being a lower-priced commodity, is affected in an appreciable degree by this extra charge. Most of the blast furnaces making ferromanganese are situated from 100 to 800 miles by rail from the Atlantic seaboard. At Pittsburgh, Pa., the additional freight of the rail haul on manganese ore amounts to about 8 per cent of its price at Philadelphia and Baltimore.

In England, on the other hand, blast furnaces making ferromanganese are within 30 miles of the coast, and the added freight by rail to these plants is much smaller. This location near the seaboard not only favors a lower cost at the furnaces but facilitates the export of the manufactured alloy.

The rail freight on chrome ore from the seacoast to interior points forms a somewhat smaller percentage of the total cost of this raw material than does the corresponding freight on manganese ore. At Niagara Falls the addition is about 6 per cent of the price at New York.

(3) The freight on the manufactured ferro-alloy is an important factor in determining competitive possibilities, except in the case of the high-priced alloys. The chief, but not the only, competitors of the United States are England in ferromanganese and ferrotungsten, France in ferrochrome, and Canada in ferrosilicon. Ocean freight on ferromanganese from England to the Atlantic seaboard of the United States is about 17s. 6d. to 20s. per gross ton (about $3.24 to $3.70, with exchange rate at $3.70). On ferrochrome the quoted rate from Havre, France, to New York has been 90 francs per 1,000 kilos (at the current rates of exchange in 1920 from $5.80 to $8.50 per metric ton—2,204.6 pounds). From Marseille to New York the quoted rate is much higher—about 80s. per gross ton (or nearly $15 at the rates of exchange current in 1920). Rates have been falling in the trans-Atlantic movement and are likely to go down still further. It may be said, however, that the export prices in England and France of ferromanganese, ferrotungsten, and ferrochrome must be at least $7 to $10 per ton less than the f. o. b. furnace prices of the American products to cause any pronounced movement to this country. This difference is not very great in the case of any of these alloys and is insignificant in the case of such a ferro-alloy as ferrotungsten, whose price ranges considerably above $1,000 per ton.

The shipments of ferrosilicon from Canada are principally by rail. The leading plant manufacturing this alloy in Canada is located at Welland, Ontario. It is thus but a short distance farther from the steel centers of this country than are the plants at Niagara Falls. With reference to the rail haul, therefore, the Canadian manufacturer is about as well located from a strategic standpoint as is his American competitor.

FOREIGN EXCHANGE.

The foreign exchange situation has affected the world trade commodities; and in many respects it has altered the compe position for the time being of manufacturers in several cou where they depend upon imported raw material. If there w uniform standard of value the world over, or a practically un standard such as prevailed before the outbreak of the war in international exchange would not be a factor in the compe situation of producers in the different countries of the world. N would it be a factor if different standards prevailed but were n adjustable to one another.

The war altered profoundly the monetary standard of the and producers of raw material in Asia, Africa, and other n have not adjusted themselves to changed conditions. The ruption of trade due to war conditions, combined with stri restrictions on the export of gold, inevitably caused variations the normal rates of exchange between the currencies of the s commercial nations of the world. In addition to this interm depreciation of monetary values by the overissue of paper cur has greatly accentuated these variations. Price adjustmen new monetary standards, especially in remote regions, take Prices which producers in different countries are obliged to p raw material often vary in a way which can not be explain the ground of ocean freights and other intermediary charges. foreign exchange situation is apparently one factor in these anomalies. Reference has already been made to the differen the prices of manganese ore between this country and Eng Late in 1919 one of the large English Steel corporations w. ported to have secured 1,500 tons of tungsten ore, c. i. f. Live at about 30s. a unit, which at the rate of exchange prevaili that time would be approximately $5.85 per unit or nearly $2 the price quoted at the same time in New York.[1]

The current rates of exchange averaged for each month June 1914 to June 1920, inclusive, are tabulated for the p sterling and the franc as follows:[2]

TABLE NO. 52.—*Current rates of exchange on the pound sterling and franc, June June, 1920.*

[Normal rates: Pound=$4.8665; franc=$0.193.]

Months.	1914		1915		1916		191
	Pound.	Franc.	Pound.	Franc.	Pound.	Franc.	Pound.
January			$4.854	$0.1935	$4.78	$0.1715	$4.758
February			4.849	.193	4.767	.1708	4.758
March			4.8125	.1901	4.765	.1702	4.755
April			4.80	.1881	4.765	.1696	4.758
May			4.80	.1881	4.762	.1690	4.756
June	$4.891	$0.1942	4.7856	.184	4.759	.1695	4.755
July	5.56	.2 4	771	.1807	4.75	.1692	4.756
August	5.56	.1961	4.762	.1771	4.759	.1698	4.755
September	5.0626	.1980	4.73	.1735	4.767	.1713	4.756
October	4.98	.1980	4.725	.1735	4.757	.1713	4.753
November	4.90875	.1963	4.714	.1718	4.718	.1712	4.752
December	4.8925	.1957	4.711	.1721	4.757	.1714	4.752

[1] Engineering and Mining Journal, Jan. 3, 1920, p. 6.

[2] Figures for June, 1914, to December, 1917, taken from Federal Reserve Bulletin, Sept. 1, 1918 and 939. Remaining quotations averaged from those given in the Annalist.

TABLE NO. 52.—*Current rates of exchange on the pound sterling and franc, June, 1914–June, 1920*—Continued.

Months.	1918		1919		1920	
	Pound.	Franc.	Pound.	Franc.	Pound.	Franc.
January	$4.757	$0.1833	$3.75	$0.09031	$3.78	$0.0899
February	4.758	.1833	3.53	.08051	3.46	.0727
March	4.722	.1799	3.51	.07956	3.64	.0722
April	4.667	.1740	3.62	.07701	3.95	.0640
May	4.667	.1700	3.63	.07571	3.84	.0665
June	4.667	.1654	3.63	.07571	3.95	.0785
July	4.569	.1626	3.63	.07571	.....	.....
August	4.494	.1557	3.63	.07571	.....	.....
September	4.439	.1375	3.63	.07571	.....	.....
October	4.439	.1460	4.19	.11747	.....	.....
November	4.419	.1449	4.10	.10901	.....	.....
December	4.259	.1365	3.86	.0953	.....	.....

The lowest weekly quotations on the pound sterling were during the months from February to September, 1919, and in February, 1920. Through these months the low quotations on the English pound occasionally reached $3.19, the minimum being $3.18. From April to September, 1919, the lowest weekly quotations on the franc averaged $0.0583, and this level was again reached in April, 1920. The highest quotation on the pound sterling in 1919 was $4.21, in October. At no time during the first nine months of 1920 did the average monthly current rate of exchange on the pound sterling reach $4.

The exchange rates on the mark have been very low. In August and September, 1919, the highest weekly quotation was $0.0301 and the lowest $0.0101. During 1920 the quotations have been around 1 and 2 cents.

The influence of foreign exchange on the trade situation of the world is not so much the result of depreciation of currency as of the failure of prices to adjust themselves to the new standards of value. In other words, the lag shown in the prices of raw material, the rates of wages, etc., when quoted in depreciated currencies somewhat handicaps the American producer whose price and wage basis is the gold standard. The uncertainties and fluctuations of foreign exchange also make inadvisable the purchase of such exchange for use in buying foreign ores.

The influence of the present rates of exchange will, of course, be of uncertain duration. They will continue until market conditions throughout the world have adjusted themselves to the new currency values of the commercial countries of the world or until the gold standard has been restored. During the period of this process of readjustment, however, the influence will be a factor, especially when connected with other influences, in the competitive strength of producers in the different countries of the world.

ELECTRIC POWER.

With the exceptions of the iron-manganese alloys and Bessemer ferrosilicon the great bulk of the ferro-alloys produced in the United States at the present time are made in electric furnaces. The largest item in the conversion cost of ferro-alloys, i. e., the cost of transforming the metal in the ore concentrate or other raw material into a ferro-alloy, is the price paid for electric power. The average percentages of total furnace and conversion costs which the expense

of power constitutes may be indicated for electric furnace ferromanganese, three grades of ferrosilicon and for ferrochrome, according to the cost figures for 1919, as follows:

	Per cent of total furnace cost.	Per cent of conversion cost.
Ferromanganese (electric furnace)	13.6	29.6
Ferrosilicon:		
8-25 per cent silicon	28.5	45.6
50-60 per cent silicon	26.2	37.1
70-75 per cent silicon	37.9	44.1
Ferrochrome	14.7	27.7

These figures show that the price of power is a very large percentage of the total expenses involved in the purely manufacturing end of the industries devoted to the production of ferro-alloys. These percentages would be somewhat more impressive if some of the overhead charges included in the costs of production could be eliminated from the manufacturing costs to which they do not strictly belong.

In the case of the higher-priced ferro-alloys the cost of electric power is a small per cent of the total expense of production but still a large proportion of the conversion cost. The big item of expense in the making of these alloys is the cost of the metal in the ore or ore concentrate. Power cost is not therefore such a determining factor, either in the geographical location of the producing industry within the United States or in its competitive strength in meeting foreign rivals. It is, however, an appreciable item in all cases.

The United States is a large producer and consumer of electric power. Much of this power is steam generated or fuel. In 1919 the production of electricity in the United States amounted to 38,900,000,000 kilowatt hours, distributed with reference to source as follows:

	Kilowatt hours.	Per cent.
Water power	14,740,000,000	37.9
Fuel power	24,160,000,000	62.1
Total	38,900,000,000	100.0

While only a little over one-third of the electricity developed in the United States in 1919 was hydroelectric, the country as a whole is well endowed with water power. As has been pointed out, however, the combination of high heads and continuous water flow is not sufficiently frequent to enable this country to produce electric power at as low rates as Canada and parts of western Europe. In a large proportion of instances users of hydroelectric power are obliged to supplement this power at certain seasons of the year with fuel power at much higher rates than those paid for water power.

Various estimates have been made of the available water power existing in this and other countries. Figures taken from different sources show estimates which were made some years ago of the available resources of the United States, Canada, and certain countries of western, central, and southern Europe.

TABLE No. 53.—*Estimated water power available in the United States, Canada, and certain European countries.*

	Horsepower available.
United States	30,000,000
Canada	17,864,000
Norway	7,500,000
Sweden	6,750,000
Austria-Hungary (former empire)	6,470,000
France	6,200,000
Italy	5,500,000
Spain	5,000,000
Switzerland	2,690,000
Germany	1,430,000
Great Britain	960,000

The above estimates are far from being close or accurate, but they serve to show in a rough way the relative amount of water power possessed by the countries named. More recent estimates have increased the figures for the United States and Canada, the estimate for the former country being approximately 60,000,000 horsepower, or double that of the figure contained in the above table. About two-thirds of the country's available water power is in the Rocky Mountain and Pacific Coast States. Three States, Washington, California, and Oregon, contain 40 per cent of the potential hydroelectric power of the country.

In Europe according to the tabluated figures the two Scandinavian countries, Norway and Sweden, have the largest available water power. These countries have also a greater horsepower per head than any other European country and much greater than the average for the United States. With a comparatively steady flow of water the cost of water power in these countries would ordinarily be low. The available water power in Germany and Great Britain is relatively small, although extensive projects are now on foot in the latter of these countries to utilize the water power existing in the kingdom.

At Niagara Falls, where the largest plants of companies engaged in the manufacture of ferro-alloys are located, the amount of water power is greater than in any other area of similar extent in the United States. Only a part of this enormous reserve, however, is available for use of manufacturers, and all of this power is now utilized. Mention has already been made of the distribution of this power between Canada and the United States. The total power generated on both sides of the international boundary line is 653,500 horsepower, of which 265,000 is generated in the United States and 388,500 in Canada. The power exported from Canada to the United States is 110,000 horsepower. Therefore of the total product of the power plants on both sides of the Niagara River the United States has available 375,000 horsepower and Canada 278,500 horsepower.[3]

While the users of power in the United States have practically 40 per cent more power at their disposal from Niagara Falls than have Canadian consumers, the policy of the present Hydroelectric Power Commission of Ontario is to keep as much as possible of the power generated in Canada at home. Inducements in the form of low power rates have been offered American producers to migrate to Canada. Some companies engaged in the manufacture of chemicals, paper, and other products for which electric power is used have taken advantage of this opportunity.

[3] Testimony of Sir Adam Beck before Committee on Water Power of the House of Representatives, 65th Cong., 2d sess., Apr. 15, 1918.

Attention has already been called to the fact that there has been a pronounced tendency for manufacturers of electric furnace ferrosilicon to move to Niagara Falls. One producer who moved from the Pittsburgh region to Niagara Falls reduced his expense for electric power by two-thirds of what he had been paying. When it is remembered that on standard-grade ferrosilicon this would be practically equivalent to a reduction of approximately one-third in the total cost of manufacture, the significance of a low power cost can be readily seen.

The rates paid for hydroelectric power in the United States vary considerably and are difficult to state with precision. The amount of power used, load factor, and in some cases season of the year, are all factors determining the rates charged. In some parts of the country hydroelectric power is supplemented by steam-generated power and the charge is made for the two jointly. Where this is the case the two can sometimes be separated in such a way that the charge for hydroelectric power alone can be stated. This, however, can not always be done. From figures secured from ferroalloy manufacturers throughout the United States and from published price statistics, the costs of hydroelectric power during the years 1919 and 1920 were found to exhibit the following ranges in different parts of the country:

TABLE No. 54.—*Rates per kilowatt hour paid by ferro-alloy producers for use of hydroelectric power in various parts of the United States, 1919–20.*

	Rates per kilowatt hour.
Niagara Falls	[1] $0.00242–$0.00306–$0.00342
North Atlantic States (Maine to Maryland, inclusive)	.0034 – .008
Southern States (Alabama and Tennessee)	.00382– .0071
North Central States	.003 – .005
Rocky Mountain States	[2].003 – .0045
Washington and Oregon	.0033 – .007
California	.004 – .007

It will be seen that hydroelectric power is cheapest at Niagara Falls, N. Y. With the utilization of water power in certain parts of Washington and California, it is claimed that hydroelectric power may be sold to manufacturers at rates lower than those prevailing at Niagara Falls. With the completion of the Skagit River project in Washington a rate as low as $18 per horsepower year is predicted for large users in the city of Seattle, which, as a municipal enterprise, is developing this project. Officials of the Puget Sound Power & Light Co., a private concern, declare that such a low rate would not cover costs. It is further said by officials of this company that the run-off of water on the mountains of the Pacific Northwest and the glacial drift are such as to make the storage of water very expensive. Whatever may be the merits of these contentions, the most promising region for cheap hydroelectric power in this country is that bordering on the Pacific.

The price paid for steam-generated power in this country is much higher. Among companies reporting charges for such power the rates range from $0.0075 per kilowatt hour to $0.0175.

In countries like Canada, Norway, Sweden, and Switzerland hydroelectric power has been much cheaper. In Ontario, Canada, the

[1] For "conditional firm energy. The regular firm energy" costs $0.00306 per kilowatt hour.
[2] Estimated in the case of one company for power owned by that company.

UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 103 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

BAR IRON

REVISED EDITION

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

C-2

Outline of tariff situation on ferro-alloys.

	Source of raw material.	Method of manufacture.	Foreign competition.	Metallic recovery from ore to alloy.	Metallic recovery from alloy to alloy steel.	Revenue possible.
Iron-manganese alloys:						
Spiegeleisen (manganese content less than 45 per cent).	Domestic	Blast furnace	Negligible	80–85 per cent	75–80 per cent	Small.
Ferromanganese (manganese content 45 per cent and over).	Foreign	Mostly blast furnace	Active	do		Relatively large.
Ferrosilicon:						
Bessemer (8 to 15 per cent silicon).	Domestic	Blast furnace principally.	Negligible[1]	do	75 per cent	Small.
Electric furnace (ferosilicon 16 per cent and above silicon).	do	Electric furnace	Active			Relatively large.
Ferrochrome:						
2–8 per cent carbon	Principally foreign	do	do	80–90 per cent	85–100 per cent	Moderate.
Less than 2 per cent carbon	do	do	do	45–70 per cent	do	Small.
Carbon free	do	Aluminum	Negligible	80 per cent or over	do	Do.
Tungsten and ferrotungsten:						
Carbon content 1 per cent or less.	do	Electric furnace and "wet" processes.	Very active	85 per cent	78 per cent	Relatively large.
Carbon free	do	Aluminum	Active	80 per cent or over	80 per cent	Small.
Ferrovanadium:						
30–40 per cent vanadium	Foreign and domestic	Electric furnace	None	75 per cent	75 per cent	Practically none.
Carbon-free ferrovanadium	do	Aluminum	do	80 per cent or over	do	Do.
Ferromolybdenum (50–80 per cent molybdenum).	Domestic	Electric furnace	Very little	78–80 per cent	90–100 per cent	Small.
Ferrotitanium:						
Ferrocarbon titanium (15–18 per cent titanium).	do	do	None, but there is potential competition.	[2]	[2]	Practically none.
Carbon-free ferrotitanium (25 per cent titanium).	do	Aluminum	Very little			Do.
Ferrophosphorus (15 per cent phosphorus).	do	Blast furnace principally.	Very little, but potential.			Very little.
Ferrouranium	do	Electric furnace	None	85 per cent	25–50 per cent	None.
Ferrozirconium	Foreign	do	do	50–80 per cent	50 per cent at best	Do.

[1] Lately there has been considerable competition in low-grade ferrosilicon, 12–15 per cent, made in electric furnaces in Canada.

[2] Used as scavenger.

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of Walter Graham, of the Metals Division of the Commission's staff, and of others.

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BAR IRON.

SUMMARY.

Bar iron is wrought, fibrous iron. It is made in the puddle furnace from pig iron. The first product is muck bar, which is cut up, piled, heated, and rolled into bar iron. Bar iron is also made from piled scrap iron, which is then treated to a welding heat and rolled into bar iron. The best grades are made from charcoal iron, as charcoal produces a purer iron in the blast furnace.

Bar iron is resistant to shock, abrasion, and rust, and it forges and welds easily. For some uses it is superior to steel; for chain and pipe[1] the United States Navy uses it in preference to steel. Its principal uses are for making crucible steel, horseshoes, stay bolts, chains, wagon and blacksmith work, and for electrical purposes. High-grade boiler tubes are usually wrought iron. With the increase in size of boilers, steel is replacing wrought iron for boiler plates, although wrought iron lasts longer (less rust). Wrought iron costs more and sells for more than carbon steel.

Domestic production of bar iron averaged, 1915 to 1918, 927,273 tons a year, valued at about $41,959,103. From 1905 to 1918 the output declined from 1,322,439 tons to 846,898 tons. The manufacture is limited to small handmade units of from 150 to 200 pounds, in competition with heats of 100 tons in steel manufacture. Since 1880, 70 works, or 80 per cent of the total concerns making bar iron, have ceased to be active. Production may be increased and costs decreased by a mechanical process, which is now coming into use, but this process is not yet on a commercial basis and because of mechanical difficulties may not be successful.

In 1918 about 50 per cent of the domestic output was made in Pennsylvania, 10 per cent in Ohio, 13 per cent in Indiana, and 9 per cent in Illinois.

Statistics of foreign production are meager and the statistics often fail to separate bars and blooms, charcoal pig iron, and steel.

In 1918 the production in Great Britain was about the same as in the United States.

In 1907 English puddling wages averaged $2.33 a ton; in 1920, $9.05. The corresponding wages in the United States were $6.50 and $14.88, respectively.

Great Britain's production declined from 2,225,000 tons in 1899 to 890,000 tons in 1905. Up to 1900 the British production exceeded that of any other foreign country. Germany produced 1,050,000

[1] Notes of conference in auxiliary file.

tons in 1900. The production of Sweden averages about 250,000 tons per annum, and is of superior quality.

Bar iron is a handmade product, requiring male labor of skill and strength. Workers earn more in other industries for the same amount of skill and work. Puddlers are not obtainable to increase production, although wages have been advanced from $5.50 per ton in 1895, to over $10 a ton in 1920.

Raw material is ample and of good quality. The mixing of steel scrap with iron scrap is, however, injurious to the product. Steel works consume both the iron and steel scrap in vast amounts, and much of the wrought iron scrap is not separated for bar iron production.

Great Britain, Germany, France, Belgium, Sweden, and the United States are the principal producers of bar iron. War conditions have greatly increased costs of production.

Imports have declined in value from $1,368,948 in 1913, to $278,189 in 1918. Domestic imports are mostly from Sweden, for special uses, because of the superior quality of Swedish iron. It is said that iron equal in quality can be made in the United States; iron made from charcoal pig iron compares favorably with the Swedish product. The amount of duty received has steadily declined from $245,200.38 in 1910, to $13,177.15 in 1918.

The tariff act of 1913 reduced the import duty on bar iron from the previous specific rate of three-tenths of a cent per pound to 5 per cent ad valorem.[1] The raw materials, pig iron and scrap iron, are on the free list.

Exports of bar iron from the United States go chiefly to Canada and Japan. Exports increased to 7 per cent of production in 1916. They have increased from 1.49 per cent of production in 1910, to 5.9 per cent in 1918.

Great Britain exports bar iron to South America and to China and Japan.

Bar steel, a product of much lower cost of production, carries an import duty of 8 per cent ad valorem as against only 5 per cent ad valorem on bar iron. The perfection of the mechanical equipment for rolling steel bars, together with the great growth of the basic open-hearth steel process (which uses a cheaper pig iron than the Bessemer process and uses scrap iron and steel up to 50 per cent of its charge) makes steel bars cheaper than iron bars. To expel the slag from wrought iron it is necessary to use a more expensive rolling process than is used for making steel bars. Raw material and conversion costs are also higher. The base selling price of iron (merchant bars is $70 and of steel bars $58, net ton.[2] The best grades of wrought iron bars (refined) are sold for $100 a ton on the same base.

[1] Notes of conditions in connection with all tariff laws from 1789, with diagram of curves of prices, rates, imports and production, are in appropriate file at the office of the U. S. Tariff Commission.

[2] Agreements between Government officials and American Iron and Steel Institute in 1917–18 and continued in force throughout control period and, to some extent, since.

Wrought-iron bars (merchant bars)—Summary table.

Year.	Domestic production.[1]	Imports for consumption.	Domestic exports.	Ratio to production.		Value (imports for consumption).	Amount of duty	Value per unit of quantity.	Actual or equivalent ad valorem rate.
				Imports.	Exports.				
	Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*				*Per ct.*
1909	2,406,125,120	68,089,435	35,931,418	2.8298	1.4933	$1,247,381.95	$245,200.38	$0.018	19.66
1910	1,871,800,000	60,888,634	40,451,028	3.2529	2.1611	1,171,433.86	216,380.12	.019	18.47
1911	2,116,329,600	50,493,967	35,046,347	2.3859	1.6560	1,016,342.79	177,740.19	.020	17.49
1912	2,209,655,680	59,620,347	51,426,996	2.5926	2.2363	1,237,166.26	210,904.57	.021	17.05
1913	1,261,503,040	40,397,868	23,071,912	3.2024	1.8289	803,763.00	57,236.51	.020	7.12
1914	1,471,919,680	23,335,219	27,652,278	1.5854	1.8786	439,167.00	21,958.35	.019	5.00
1915	2,226,443,520	17,939,661	157,964,375	.8058	7.0949	514,367.00	25,718.35	.029	5.00
1916	2,203,994,240	9,329,410	144,889,017	.4233	6.5739	410,212.00	20,510.60	.044	5.00
1917	1,897,051,520	3,806,488	112,539,425	.2007	5.9323	263,543.00	13,177.15	.069	5.00

[1] Annual statistical report for 1918 Am. I. & S. Inst. Census reports are not complete. Do not include that made and consumed by the producing establishments in the manufacture of more highly finished rolled products.

General Information.

Tariff act of 1913, paragraph 103: "Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or rods, bars or shapes of rolled or hammered iron not specially provided for in this section, 5 per centum ad valorem."

DESCRIPTION.

Muck bar is made from puddled pig iron. Steel scrap can not be used. It is the raw bar from which bar iron is made. It is 6 inches wide and five-eighths inches thick; it is rough and used only for making bar iron, being cut up, piled, heated to a welding heat, and rolled into bar iron. It is sold as a raw material to bar-iron mills, but is generally used by the makers in their bar mills.

Bar iron is the finished iron, made from piled muck bar or from piled scrap iron, rolled or hammered into lengths usually 12 to 16 feet, and into a variety of sections and sizes.

Square iron is bar iron of square section. It is made from three-sixteenths up to 7¼ inches square.

Round iron is bar iron of round section, made from three-sixteenths to 7¼ inches in diameter.

Other shapes are bands, flats, half oval and half round, horseshoe iron, beveled edge box iron, and oval.

The trade recognizes various stages of advancement in value by quality, shapes, sizes, cutting to specified length, straightening and centering, and for quantity.[1]

Common merchant iron is made entirely from common scrap (mixed iron and steel and low grades).

Refined iron is made entirely from selected wrought scrap or from puddle bar and selected wrought scrap. Steel scrap can not be used in this grade of wrought iron. According to prices fixed by the President in 1917 and 1918, this material sold at $1.50 per pound more than merchant bar iron (which was fixed at $3.50).

Double refined iron is made by cutting up refined iron bars, piling, heating, and rolling into iron bars.

[1] For list of shapes, sizes, and extras, see auxiliary file.

Charcoal bar iron is the highest grade. Charcoal fuel being free from sulphur makes a purer iron.

Skelp iron, for tubes of high grade, is made in the charcoal sinking fire. Steel scrap can be used in this process as it is recarbonized to about 2 per cent carbon, fused into a bath, and the carbon is removed (oxidized). This is practically a charcoal puddling process, the silicon of pig iron not being present.

Busheled iron is scrap heated to a welding heat and rolled.

Wrought iron,[1] also called malleable iron in England, is iron low in carbon, produced in a pasty condition (owing to the temperature employed being too low to render it fluid), in consequence of which a small percentage of slag is mechanically intermingled with it. The percentage of carbon is usually under 0.15 per cent and that of the other constituents (not including the slag) under 0.25 per cent. It can be forged or rolled, and welded, but is not appreciably hardened by rapid cooling (quenching). It is made by the puddling, a direct, or a charcoal hearth process.

Wrought iron[2] is almost the same as the very low carbon steels, except that it is never produced by melting and casting in a mold, but is always forged to the desired size and form. It usually contains less than 0.12 per cent of carbon, which finishes it in a pasty, instead of in a liquid form and leaves about 1 to 2 per cent of slag mechanically disseminated through it.

"Malleable compounds of iron with its ordinary ingredients, which are aggregated from pasty masses, or from piles, or from any form of iron not in a fluid state, and which will not sensibly harden and temper, and which generally resemble what is called 'wrought iron' shall be called weld iron."

For the interpretation of tariff schedules and the filling of engineering contracts, a committee of eminent metallurgists reported the above description of wrought iron to the American Institute of Mining Engineers, in October 1876.[3]

Structure.[4]—The rope-like structure of wrought iron fits it peculiarly for dymanic strains, each fiber offering its individual resistence to longitudinal rupture.

Corrosion resistance of wrought iron may be due to each fiber being enveloped in ferrous silicate (slag or cinder), but is more probably attributable to its purity.

Rolled iron is formed in rolling mills.

Hammered iron is formed under a hammer.

Bar iron has advantages over steel because of its resistance to shock, strain, abrasion, and rust. Its uses may be extended as a result of cheapened production by mechanical processes now being introduced,[1] but so far none of these mechanical puddling methods has proved commercially successful.

Bar iron is used for making crucible steel, for blacksmithing, car, wagon, and locomotive irons, horseshoes, horseshoe nails, chains, boiler tubes, roofing, and for electrical purposes. The Navy prefers wrought iron to steel for chains and boiler tubes, as it does not corrode and crystalize as steel does. The ideal for ships in England is an all wrought-iron ship.

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[1] Iron and Steel, Tiemann, 1910, p. 352.
[2] The Metallurgy of Iron and Steel, 1913, Stoughton, p. 4.
[3] The Manufacture and Properties of Iron and Steel, Campbell, 1907, p. 92.
[4] A B C of Iron and Steel, 1919, p. 101.

DOMESTIC PRODUCTION.

From colonial days until 1870, when the Bessemer steel process was being introduced, bar-iron production was very important. Since the great growth of the steel industry it has become relatively small. In 1913, the production was 1,026,632 tons valued at $44,513,315, and in 1918, 846,898 tons valued at $86,298,906.

The *raw materials* are pig iron, scrap iron, and iron ore. The fuel is coal. The supply of scrap is not adequate, more wrought-iron scrap being needed. The separation of wrought-iron scrap from steel scrap is necessary in the manufacture of good bar iron. The steel furnaces use both, which makes it difficult for the bar-iron manufacturers to obtain wrought-iron scrap to meet the specifications for wrought bar iron, which makes unavailable the use of steel scrap, as it gives a crystalline instead of a fibrous structure. Scrap, pig iron, and iron ore are admitted free of duty.

Equipment.—Equipment is massive, not of complicated design or construction, and is not imported. The United States has the advantage in procurement of equipment because of resources of materials and ability of producers. It consists of railroad tracks and scales, mill buildings, puddling (single and double furnaces) and busheling furnaces, sinking furnaces, waste-heat boilers, engines, squeezers' rolls, hot beds, and shears, for both scrap and bars. Hand labor is important. The process of expelling the surplus slag from the iron bar does not permit the use of the three high rolls and automatic tables that cheapen the production of steel bars. The mechanical processes of puddling and busheling (still in an experimental stage) will add to the equipment and lessen labor costs, if it becomes commercially successful. The scrap yard, in which the scrap is sorted, cut, and piled, is an important part of the plant. The equipment here has generally consisted of shears only, but a few larger plants have the traveling crane with electric magnet to lift the scrap. Oxy-acetylene cutting equipment is also commonly used for cutting up heavy scrap into convenient sizes for handling.

Methods of production.—Wrought iron was made in the early days direct from pure iron ores and charcoal. The process developed into the Catalan forge chiefly used in the Southern States and the American bloomery used largely in the Champlain district. The maximum production was achieved in the United States in 1882, but owing to the high cost of charcoal and uncertainty as to the character of product, the direct process has now practically disappeared.

Wrought iron is now made almost wholly from pig iron and scrap, using coal as fuel. Instead of reducing the oxide ore to pure iron, the process now consists of removing the impurities (silicon, manganese, and carbon, together with most of the phosphorus and sulphur) from pig iron by working the metal in a pasty condition in the presence of mill scale (iron oxide) and iron ore for purposes of oxidation and then welding and rolling the partly fused mixture of pure iron and slag. The use of coal as fuel precluded the possibility of direct contact with the iron as in the charcoal process so reverberatory furnaces are employed which burn the coal on a separate hearth, only the gases coming in contact with the metal.

The process commonly employed at the present time is called "hand puddling," in which the iron is heated on the working hearth until it becomes pasty but not liquid. In order to obtain effective oxidation fresh surfaces must be exposed to the hot gases and the oxidizing agents (mill scale and ore). The boiling of gases (oxides of carbon) in the mass is not sufficient, so the mass must be agitated with iron bars (rabbled) almost continuously after it begins to fuse and until all impurities are removed from the iron and the mixture of iron and slag is balled up and removed from the furnace to the squeezer. The intermediate steps are called "graining," "boil," and the "turn." The work involves an enormous amount of heavy physical labor, combined with a high degree of skill on the part of the operators, in spite of all the care that can be given in the selection of raw materials and chemical control.

The "ball" is drawn from the furnace and placed in a "squeezer," where it is squeezed into the form of a cylinder about 6½ inches in diameter, expelling most of the cinder (slag), but not altering the shape of the individual grains of iron. This cylinder or "bloom" is reduced by rolling to a puddle bar about 6½ by ⅝ inch in section, a reduction of area of about 8.8 to 1. This reduction is communicated to the individual grains of iron, which become long fibers. The puddle bars are cut up into lengths of about 3½ feet and piled. The pile is then heated to a welding heat and rolled out to about 70 feet or to about twenty times the length of the puddle bar. This increase in length is also communicated to the fiber, which is now about one hundred and seventy-six times as long as that in the bloom. Since the original grain is one thirty-second to one-sixteenth inch in diameter, the fibers in the finished iron are 5 to 12 inches long, which is the secret of the strength and toughness of wrought iron. Similarly, when the piled puddle bars are rolled into plate the fibers are rolled out into disks which give transverse as well as longitudinal strength.

A certain amount of iron is reduced from the mill scale and iron ore which enters the bath, but the subsequent losses of iron are so great that there is a net loss of 5 per cent in the weight of finished wrought iron as compared with the iron in the pig iron and scrap charged.

The sinking of iron or steel scrap in a charcoal hearth, similar to the American bloomery, is one of the processes in vogue to-day. This gives a greater transverse strength (due to less slag), making the product, when rolled into iron skelp, admirably fitted for boiler tubes.

Busheling consists in the welding together of miscellaneous scrap on the hearth of a furnace similar to a puddling furnace. In days when scrap was all wrought iron good wrought iron was made in this way. In the practice to-day when steel predominates in the scrap the product lacks uniformity and the best attributes of genuine wrought iron.

Mechanical means and large units in manufacture, with resulting low cost and the production of high-grade iron, will avoid the evils of piling, high labor, excessive iron loss, and possible laminations, the last being the only inherent defect of wrought iron made to-day.

The Roe mechanical puddling process of the Reading Iron Co., Reading, Pa., is an interesting effort to make mechanically puddled iron in units of 6,000 pounds by one expert puddler, instead of units of 150 to 200 pounds. The plant was very completely and very expensively built in 1912, but was idle during the war, and the inventor is endeavoring to make it commercially successful, the mechanical difficulties being very great.

Rolling.—Reversing mills or three-high mills are not used, although labor saving, as the bar must be rolled only one way to expel the slag. This is done more effectively by cutting the muck and piling and heating and rolling it into bars on a two-high mill, which rolls in only one direction, the bar being passed back by hand. The three-high mill, on which steel bars are rolled, receives the bar on an automatic table, lifts it to the upper pass; the rolls carry the bar back to the automatic table on the other side of the rolls, reducing its section; the steel bar automatically goes back and forth, being reduced in section by each pass. This is one reason the iron bar can not compete with the steel bar in price.

Refined iron is also made by cutting and piling muck bar and selected wrought-iron scrap.

Common iron is not made by any of the above processes. It is made simply by cutting and piling common scrap (miscellaneous unsorted iron and steel), heating, and rolling into bars.

Hammering, originally the method of reducing the section of the bar, expelling the slag and welding the fibers, has been almost entirely supplanted by rolling.

Excepting the mechanical process of puddling and busheling, which is American, the processes are English.

Organization.—The older factories required an investment of $100,000 to $250,000; the new mechanical plant at Lebanon, Pa., $750,000. It remains to be seen to what extent the organization, market, and capital requirements will be developed by the mechanical process.

There were, in 1916, in the United States 63 merchant bar manufacturers, of which 29 manufactured bar iron exclusively, while 49 manufactured both iron and steel bars.

Geographical distribution.—In 1916 there were 45 works in the East, 5 in the Southern States, and 13 in the Middle West,—two-thirds of all these being in Pennsylvania.[1]

History.—While economies have resulted from changes of processes, no improvement has been made in quality of wrought iron. The old Catalan forge iron, though frequently irregular in different heats, was the equal of any iron made to-day.

About the middle of the fourteenth century the German metallurgists increased the size of their furnaces producing wrought iron, steel, and cast iron. Charcoal was used as fuel. The iron produced needed refining, and this led to the indirect process.

The exhaustion of the forests in England led to the passing of a law in 1557 prohibiting the cutting of wood for iron making. In 1735 Abraham Darby successfully used coal by coking it in heaps. Charcoal iron is low in sulphur and silicon. Coke increased the

[1] These data apply to both iron and steel bar mills. The distribution of iron-bar mills is not separately stated.

sulphur. This required higher furnace heats, which increased the silicon and lowered the sulphur. The silicon had to be removed. In 1784 Henry Cort accomplished this by using coal for refining iron, introducing the puddling and rolling processes, which were of enormous benefit to the world. The iron loss was 50 to 70 per cent, but this process made available cheaper fuel. The Napoleonic wars made a demand for iron at any cost and destroyed the industry on the Continent, giving England the advantage, which developed the Cort process rapidly.

In 1830 Joseph Hall invented the pig-boiling process, which has been the chief producer of wrought iron. In the absence of chemical analysis, a constant grade of pig iron was necessary. In colonial times America had the comparative advantage because of cheap charcoal and limestone and easily reducible iron ores of good quality practically on the surface of the ground. At this time wrought iron was hammered in primitive forges. The use of coal in puddling and rolling by Cort's inventions gave England the comparative advantage, in spite of a protective tariff against English rolled iron. In 1840 anthracite and bituminous coal began to be used in iron manufacture in the United States. This greatly increased production, and iron works increased notwithstanding lower import duties. In 1860 the Bessemer steel process began a second revolution in the trade, and displaced wrought forge and puddle iron largely. In 1870 the production of open-hearth steel began, which is displacing Bessemer steel.

Through three-quarters of the nineteenth century the world used wrought iron as its chief supply of bars. As a hand-made product it has not kept up with the tremendous demand. It is made in small units of 150 to 200 pounds, whereas steel is made in 100-ton units, largely mechanically. Steel has therefore met the demand. Since 1905 the production of bar iron has declined. In 1913 the production was 1,026,632 tons; in 1918, 846,898 tons.

The manufacture of iron blooms and hammered bar iron for sale in forges and bloomeries, originally the source of supply of bar iron, is a passing industry. In 1880 there were 93 active establishments; in 1900 only 7. In 1914, 35,794 tons were hammered.

Domestic production and consumption.—Production averages about 845,000 tons a year and has been declining since 1905. It is probably not sufficient for domestic needs, as some is imported, and if it could be made more cheaply it would replace the cheaper steel bars for certain uses. Production is limited because of the small units, usually 200 pounds each, the manual labor involved, and the competition with large steel units (100 tons or more) and mechanical methods used in producing steel. The mechanical puddling process has started to make 5-ton units. The successful development of this process would change the above condition materially.

Wrought iron has been displaced by steel for many purposes. For some uses, however, it is superior to steel. The labor cost and individual skill required has restricted the output. Puddlers are almost extinct. The heat of summer is very hard on them, as they work close to the furnace, rabbling the bath of melted pig iron and gathering the particles of iron into balls and drawing them from the furnace. Scrap being stored in the open, severe winter storms cut off the

supply. Apart from the above, the seasons have no effect on the business. For the same amount of skill and hard hand labor involved men can get better remuneration in other industries and puddlers are not obtainable to increase production.

Dependent industries—Blacksmithing, pipe works, crucible steel works, machine shops, boiler works, wire, nail works, structural works, car and locomotive works, horseshoe and horseshoe nail works.

Domestic exports increased in 1916 to 7 per cent of production, due to the war. Prior to that it was about 2 per cent. (See p. 9.) Exports go mostly to Canada and Japan. Domestic exports in 1913 were 2.24 per cent of production, valued at about $1,000,000. In 1918 they were 5.93 per cent of production, valued at $5,436,000.

FOREIGN PRODUCTION.

Sweden produces about a quarter of a million tons of bar iron a year of a very high quality, used largely for making crucible steel. The price is quoted by The Hardware Age, January 1, 1920, at 20 cents a pound, as compared with 4 cents a pound for domestic bar iron. It is the highest quality of iron in the world, being made from very pure ores and charcoal.

England before the war produced a little over 1,000,000 tons a year. In 1918 the production was 786,588 tons a year. Formerly costs in England were lower than in the United States, due to cheap fuel, low wages, and short railroad hauls. Costs in England are now, 1920, greatly increased, coal being three times the prewar cost, and, because of the shorter hours worked in the coal mines, there is a shortage of coal (estimated by the U. S. Geological Survey at 77,000,000 tons a year). The export price, April, 1920, of bar iron is £20 per long ton. Even this price, the Iron and Coal Trades Review states, is not believed to be enough to cover costs of production.

Belgian bar iron was made even cheaper than in England, wages being lower in Belgium than in England. The war has destroyed many Belgian iron works, but reconstruction has been rapid and, in spite of the scarcity of fuel, Belgium is recovering some export trade.

Germany, because of the war, is not feared as a competitor unless she recoups from Russia the iron ore lost to France. Undernourishment in Germany with transportation difficulties and lack of raw material causes a low stage of production.

Russia seems to be prostrate as to ability to produce, communism there leading to neglect of plants and paralysis of transportation. Early in the history of the United States Russian iron was imported for its quality.

France, with the iron and coal reserves acquired from Germany and great recuperative powers, may lead England in low costs of production. The accumulation of war scrap in France is to her advantage.

Canada produces about 100,000 tons a year, but the exports of bar iron are negligible.

Japan is making every effort to increase iron and steel production, securing pig iron and iron ore from China; also iron ore from Chile, and it is said that she has secured the large Durango iron ore deposit in Mexico. Japan is agitating for more protective tariffs, and other help from the Government to iron and steel manufacturers. At this writing (June, 1920) the press states that Japan is seeking oil concessions in Mexico.

IMPORTS.

Imports have remained relatively stationary since 1890—about $1,250,000—until the war, when they steadily declined to $278,189 in 1918. In 1913, 84.5 per cent came from Sweden; 14.5 per cent from the United Kingdom; one-half per cent from Belgium; and 1.2 per cent from Germany. Imports have been constant and supplementary and are declining. Swedish iron goes mostly to New England for special uses, and because of its water transportation, which is not much more costly than the American rail haul before the war.

Imports in 1913 were 2.20 per cent of production, and were valued at $1,237,166. In 1918 they were 2 per cent of production, and were valued at $263,543. Duties paid in 1913 were $210,904.57; in 1918, $13,177.15.

PRICES.

The price of iron bars is quoted above that of steel bars. In 1913 the price of iron bars averaged $1.69 per 100 pounds; that of steel bars, $1.55 per 100 pounds. In 1918 iron bars were quoted at $4.31; steel bars at $2.89 per 100 pounds. (For prices from 1872 to 1911, see p. 28.)

International price comparisons [1] *(per long ton).*

	1913	1915	1918
United States	$40.32	$38.98	$109.76
England	37.71	37.71	68.09
Germany	68.08	66.24	.....

[1] International Price Comparisons, Department of Commerce, 1919.

TARIFF HISTORY.

The tariff history of bar iron in the United States begins with the duty of 7½ per cent ad valorem imposed in 1789. At this time the comparative advantage over England in the manufacture of bar iron was with the United States because of cheap charcoal in proximity to easily smelted iron ores of good quality which were practically on the surface of the ground, and of cheap limestone of good quality. Pure bar iron was imported from Russia. In 1792 the duty on bar iron was raised to 10 per cent ad valorem but was reduced to 5 per cent in 1794. In 1803 the war between France and England made markets for the United States. The embargo of 1807 and other laws affected trade with England. During the war of 1812 the manufacture of bar iron was again quickened and prices advanced until 1815, when peace was established.

Early in the nineteenth century, hammered iron was made in the United States. England developed Cort's inventions of puddling and rolling. In 1816 a duty of $1.50 per hundredweight ($33.60, gross ton) was placed on rolled iron and $0.45 per hundredweight on iron in bars and bolts. Costs favored England whose coal cost $8 per ton of bar iron produced against $27 to $42 per ton of iron for charcoal in the United States. England controlled our markets after the war and dumped manufactured goods in the United States.

This was a period of large imports of bar iron. In 1824 the duty was raised to 90 cents per 112 pounds. Imports increased, as there was great prosperity and high prices in the United States with low prices in England. In 1828 the duty was raised to $1 per 100 pounds.

In 1831, 60,000 to 70,000 tons of domestic bar iron were made.

In 1832 the duty was reduced to 90 cents for 112 pounds. In 1837 there was a financial crisis. Prices declined. Imports were increasing from 1828 to 1842. The United States lacked capital and continued the older charcoal processes instead of using coal and could not supply the increasing domestic demand. In 1839–40 there was a depression in England. In 1840 to 1842 there was a business depression in the United States with declining imports. In 1840 anthracite coal was used in domestic furnaces and hot blast was used in 1842.

In 1841 the production of bar iron was 197,233 tons in the United States. In 1842 a duty of $17 a ton was imposed. There was a domestic business revival and domestic production increased to 300,000 tons. Prices advanced. Anthracite was used in puddling in 1844. In 1846 a duty of 30 per cent ad valorem, equal to $27.50 a ton—the price of a ton was $91.50—was imposed. Railroad building was active and population and consumption increased. Production was 650,000 tons. The hand-puddling process could not supply the demand. Imports increased.

In 1850 the use of coke began.

From 1852 to 1857 there was a rapid growth of railroads. In 1853 and 1854 imports equaled production. In 1856, 500,000 tons were made. In 1857 there was a financial panic. In 1858 to 1860 railroad building was active and production increased to 513,312 tons. Imports increased also. In 1861 the duty was placed at $15 a ton. Imports declined, prices increased. In 1862 an additional duty of $3 per ton for iron exceeding $50 per ton in value was imposed.

In 1864 a duty of 1 cent a pound was imposed and the price advanced to $145 a ton, declining to $96 in 1872. Imports increased because of industrial development. In 1867 the Bessemer steel process was started and the price of bar iron and imports were reduced. In 1872 the duty was reduced to 0.9 cent a pound. Imports and prices declined. In 1873 there was a financial panic. This and the growth of the steel business caused prices and imports to decline. In 1877 steel rails in England were quoted at $31 a ton. In 1879 there was a revival of domestic business, and in 1880 there were 93 domestic works.

In 1883 the duty was increased to 1 cent a pound. In 1889 Europe needed iron. In 1890 basic open-hearth steel production was 90,000 tons. In 1892 domestic production of Bessemer steel exceeded that of Great Britain. Prices of iron bars declined until 1894. In 1893 there was a financial panic. In 1894 the duty was placed at 0.6 cent per pound, and was not changed in 1897. Exports began, and prices were lower than in England. Expansion in business followed, prices advanced, and imports increased.

In 1905 the production of bar iron was 1,322,430 tons. In 1908 puddlers' wages were $6.50 per ton in the United States, and $2.33 in England. In 1909 the duty was reduced to 0.3 cent per pound.

Imports increased. Puddlers were not obtainable to increase bar-iron output. Steel production, Bessemer, was 9,323,783 tons, basic open hearth, 13,417,472 tons. In 1910 the production of bar iron was 1,074,163 tons, and in 1913 the production was 1,026,632 tons, valued at $44,155,442. The duty was 5 per cent ad valorem under the act of 1913. Imports were 26,600 tons.

In 1918 the production of bar iron was 846,898 tons, valued at $86,315,844. The wages of puddlers advanced to $11 a ton. In May, 1920, wages of puddlers were $14.88.

Until the production of steel was increased by the Bessemer and open-hearth processes, about 1880, bar iron was a very important item in the iron and steel tariff schedules. Many American iron-masters had been officers in the Revolutionary War, as many early fortunes were made in the manufacture of bar iron, which in early days was charcoal iron. After 1880, as a handmade product, bar iron production could not supply the great demand for iron which was met by the manufacture of steel, particularly of basic open-hearth steel. Steel production has increased from 1,247,335 tons in 1880 to 44,462,-432 tons in 1918.

COMPETITIVE CONDITIONS.

In recent years the chief competitor of the American bar-iron industry has been the American production of mild steel bars. The fairly extensive importation of Swedish iron before the war may be considered as supplementary, being of higher quality than any iron produced in quantity in the United States. A certain amount of high-grade Swedish iron will doubtless be imported in future years in spite of the fact that iron of equal quality may be produced in American works. Since 1914, the premium on Swedish iron as compared with that of American make has greatly increased, and in January, 1920, it was quoted at five times the price of American iron. Swedish competition in American markets is not a matter of price, but depends largely upon the purity of the material and its established reputation.

Competition with steel bars.—Bar steel is made in vast quantities with the aid of highly developed mechanical equipment and production methods. The labor employed is not so highly skilled and the work is by no means as arduous as that required in the manufacture of wrought iron. It is increasingly difficult to get puddlers, since men having the requisite intelligence can generally obtain better wages for less effort in other lines of work. The result has been that whole districts have abandoned the production of wrought-iron bars and more and more soft steel has been substituted for iron. In 1880, there were 93 active works in eight States whereas in 1916 there were only 63 active works. The decline in output can not be attributed to foreign competition but is due solely to the competition of bar steel which, under American conditions and large outputs, can be produced much more cheaply and, for many purposes, is quite satisfactory. It is possible that a mechanical puddling process may be developed which will materially lower the cost of producing wrought iron, and at least one costly experiment is now being tried in this country with this object. But there is no immediate prospect of commercial success along these lines and the methods of production are very much the same as they were many years ago.

There are little data as to comparative costs of bar iron and steel. One bar-iron manufacturer states that in 1913 the cost of producing bar iron was $28.77 per ton; in 1918, $66.16 per ton; and in 1920 (prior to the July increase in puddlers' wages), $81.26 per ton. The War Industries Board determined the cost of steel bars in June, 1918, as $41.77 (low cost). The difference in cost is recognized in the trade as a price differential. The base price in Pittsburgh in March, 1921, for steel bars was $2.00 per 100 pounds; for ordinary merchant iron bars, Philadelphia, $2.45.

Foreign competition.—The large amount of manual labor involved in the production of wrought iron introduces a new element into the competitive status of the domestic and foreign manufacture of bar iron as distinguished from other branches of the iron and steel industry, where organization and mechanical equipment have to a greater degree offset the better wages paid in the United States.

England since colonial times has been the important foreign competitor of the United States. The processes used are English. Because of the stamina and intelligence required and her resources of coal and iron England has been peculiarly well equipped for this business. In addition to this, England has developed her mercantile marine, trade routes, banking and trade connections and facilities over the world. England competes with the United States in Spanish America, China, and Japan. Her exports of bar iron to the United States in 1913 were 2,223 tons, valued at $205,367 [1]; to Brazil about 83,000 tons, valued at $7,500,000; to China, 85,280 tons. Her costs have greatly increased since the prewar period due to advanced transportation, coal, and labor costs. The export price of bar iron was advanced £5 in January, 1918, to £20 per ton. The bar iron convention stated that this was scarcely sufficient to cover the increased costs of production.[2] England's exports of bar iron have declined progressively from 720,733 tons in 1913 to 128,287 tons in 1918. Subsidies were removed early in 1919, followed by advance in prices. English trade journals state that American competition is feared and that wages have advanced 108 per cent over the prewar basis. The puddling rate per ton in March, 1920, was $9.05 in England and in the United States $14.88.[3] Late in 1920 the British rate ranged from $7.50 to $8.27.

Sweden, while not a large producer (250,000 tons a year), makes bar iron of high grade, largely for crucible steel, which brings a high price—£50 a ton in 1919. Sweden exported to Great Britain in 1913, 52,188 tons; to the United States, 27,520 tons, valued at $1,148,675. Sweden does not expect to hold her trade in wrought iron in the United States.

Germany has lost much of her iron resources to France. Malnutrition has so weakened her workers that it would not be expected that they could produce bar iron to advantage, as it is a very exhausting labor.

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[1] The Iron Trade Review, Jan. 19, 1919, p. 39.
[2] The Iron Trade Review, Jan. 31, 1919.
[3] Paul M. Tyler, of the Tariff Commission's staff, who investigated conditions in England, estimated the cost of puddled bar iron in 1919 at $70.90.

Belgium is normally a low-cost country, and is now recovering rapidly from the war.

France is also normally a low-cost country. Andre Tardieu states that she will lead the world in iron production. His prediction no doubt is based largely on the fact of the loss of German iron reserves in France.

Japan is striving to supply the Pacific regions and is increasing her production by importing iron ore and pig iron and by Government protection of her iron manufacturers.

The United States has high labor costs. Puddlers' wages have advanced from $5.50 a ton in 1895 to over $16 a ton in 1920, and puddlers are and have been for years almost unobtainable. The mechanical process may meet this condition, and if successful the comparative advantage may be with the United States in bar iron, as it is with steel, although there is no patent protection for this process in Europe.

THE FUTURE OF IRON COMPARED WITH STEEL.[1]

"In his presidential address to the Staffordshire Iron and Steel Institute (British) G. Carrington prophesied that the demand for iron in the future will greatly exceed that of the past. Its greater suitability for sheets, whether black, painted, or galvanized, is generally conceded, its life being fully five times that of steel, and even in present conditions it is again ousting steel for railroad and colliery work, ships' decks and hatches, and where there is exposure to severe weather or to acidic liquids. Then there are plates, girders, and bars for bridge building and structural and agricultural purposes, and particularly for ships. He expressed the conviction that, given the material at a reasonable price (not the same price as steel, because it will always command a better price for these purposes than steel), we shall in our time see the all-iron ship. But it is necessary to devise methods by which the necessary output can be obtained, and in his opinion there is no way except by large gas-fired mechanical puddling and scrap furnaces of anything up to about 5 tons, with corresponding mill and other necessary plant. There will then be no difficulty in producing ships' plates and girders in the large sizes now required, without which an iron ship could not be economically built. The rudder and stern may give trouble, and steel would perhaps be specified on account of the thickness, weight, and shape required, and also the relative unimportance of rusting, but for plates, girders, bars, etc., for bridge building and structural work there would be no difficulty.

"A puddling research committee has been formed by the whole of the iron trade associations of the country, and it is to be hoped that something may be done to relieve the puddler of some of his heavy work. At present it is proposed to confine the investigations to 10-hundredweight furnaces, but while that proposal represents a great advance, Mr. Carrington thinks it is much too timid. Producers must learn to talk in tons where they now think in hundredweights, and iron can be produced as economically as steel only on the same scale."

[1] The Iron Age, Jan. 9, 1919, p. 126.

FUTURE DEVELOPMENTS IN PUDDLED IRON MANUFACTURE.[1]

Compared with modern open-hearth steel furnaces, the coal-fired puddling furnaces use three to five times as much coal per ton of product. The labor cost and cost of up-keep are abnormally high. The rolling and handling plants are crude and wasteful.

From 1905 to 1915 the output of puddled iron in the United Kingdom was 1,000,000 tons per annum. Of this, 250,000 tons were iron and steel scrap bar. Six tons of coal were used per ton of bars made. Fifty per cent of the coal and one-half of the labor cost could be saved by better plants.

"It is of interest to learn that rotary mechanically operated furnaces are in use in the Lebanon Valley Iron & Steel Co.'s works in Lebanon, Pa., United States of America for making scrap balls from turnings and light scrap balls of 5 to 11 hundredweight being produced. These furnaces use pulverized coal and forced draft, the waste gasses passing through tubular boilers, a boiler being fixed to each furnace. This is an indication that in the United States the mechanical balling and puddling furnace is being developed, and should encourage a move here in the very desirable direction of saving labor and fuel costs."

Mechanical puddling.[2]—A new plant of the Lebanon Valley Iron & Steel Co., Lebanon, Pa., puddles iron mechanically, a modern method of producing muck bar. Great savings in labor costs are expected. (Lebanon Valley Iron & Steel Co. wrote the United States Tariff Commission, Jan. 24, 1920, that their furnaces are not puddling furnaces. "They are simply a rotary scrap furnace." "We are able to rotate this furnace, which simply rolls the iron up after it gets to a proper heat." "The grade of iron made in these furnaces, however, is slightly better than that made in the old furnace, but we are so new at it we are absolutely unable to give you any figures.")

More than six years ago, the first mechanical puddling furnaces in the United States were put into operation by the Glasgow Iron Co., of Pottstown, Pa., the invention of James P. Roe.

Other works using mechanical furnaces are the Reading Iron Co., of Reading, Pa., under the Roe patents. (A report of this process made by an agent of the commission after examination of this plant with the inventor is in the appropriate file at the commission office. The plant, although well constructed in 1912, is not yet in successful operation, the mechanical difficulties seemingly being too great.) The Sellers Manufacturing Co., Chicago, have rotary balling or busheling furnaces of Sellers and Lentz design. They report them as operating successfully for a number of years and they replace this old-fashioned busheling furnace. As mentioned above, the Lebanon Valley Iron & Steel Co. has built a new rotary scrap mill of Ely pattern at a cost of $750,000; the Highland Iron & Steel Co., Terre Haute, Ind., have several Ely furnaces.

The advantage claimed for mechanical puddling is that labor cost is only 20 per cent of the hand puddling cost. By the old method, two skilled puddlers with two helpers made small units or balls of 150 to 250 pounds each. Puddlers' wages are (1920) $14.88 a ton, double

[1] J. E. Fletcher, Iron and Coal Trade Review, Nov. 28, 1919.
[2] The Iron Age, Nov. 27, 1919.

the rate paid a few years ago. The new mechanical puddler is designed to produce a ball of 6,000 pounds by one skilled puddler. Liquid pig iron is used, saving much fuel.

The mechanical scrap process employs 12 men to 8 furnaces, handling scrap and coal. Labor is distributed for a plant of capacity 160 tons, 12 hours—

12 men.
8 for raw material.
4 at furnaces—8 furnaces.
1 puddle ball and bloom conveyors.
1 engine and pump.
1 dragout and transfer on cooling beds.
2 shears.
3 cranes.
2 common labor.

Twelve minutes for heat; 750 pounds puddle ball; 1,000 to 2,000 expected; 10 per cent loss of scrap. Will use powdered coal. Gases pass into waste heat boilers to generate electric power and drive mill and squeezer engines. Puddle ball goes on conveyor to squeezer, then conveyed to the roughing mill.

Tests.—American Society for Testing Materials. Tensile strength for refined wrought-iron bars is 48,000 pounds per square inch. Elongation in 8 inches, 22 per cent. Lebanon Valley Iron & Steel Co. bars have shown tensile strength 50,200 to 54,200 per square inch. Elongation 27 to 30 per cent. A better grade of iron than by old, method as material can be worked more uniformly in rotary furnaces than by hand puddling. Every piece of scrap heated alike; by hand puddling inside of ball half heated, outside too hot. Steel scrap is decarbonized in rotary furnace, which first makes a very large ball, 750 pounds, which comes out of the squeezer a bloom 42 inches long by 9½ inches diameter, which is worked down to 4, 3, 2½ or 2 inch billets, which gives work and fiber and strength and elongation. The more the iron is worked, forged, or rolled to reduce area of cross section, the better the iron. This expels slag and welds the iron. Phosphorus, silicon, and carbon are hardeners.

TARIFF CONSIDERATIONS.

Muck bar is a semiraw material used for making bar iron, the latter being heated and rolled into bar, either with or without the addition of steel or wrought-iron scrap. The duty on muck bar, however, has been the same as that on bar iron, both under the ad valorem rates of the 1913 act and the specific duties of the 1909 act.

Manufacturers of bar iron claimed in tariff hearings that a tariff differential should be maintained in favor of iron bars as compared with steel bars, the differential being equal to the difference in cost of production. The act of 1913, however, imposes a duty of 8 per cent ad valorem on steel bars as against 5 per cent on iron bars. The prediction was also made that without a protective duty the bar iron mills would have to go out of business, and emphasis was laid upon

the desirability of specific duties to protect the industry when prices were low as well as when prices were high.

There is no question as to the greater cost of producing wrought iron (at least under present conditions) compared with that of steel bars. Price differentials are maintained ranging from $12 to more than $40 per ton, depending upon the quality of the wrought iron (that is the content of steel scrap).

The effect of the tariff has not been clearly reflected in the imports. These increased somewhat with the lowering of the duty from 0.6 per pound in 1894 to 5 per cent ad valorem in 1913 but represent only a small fraction of the production and are practically balanced by exports. The decline in imports from 1914 to 1918 was the result of war conditions as was also the increase in exports. The extent to which Swedish iron has been permanently displaced by American refined iron can not be determined. It is claimed that as good iron can be made in the United States.

Bar iron—Production in United States—States.

[From "Federal Census."]

States.	1899		1904[1]		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
Indiana	7,536	$233,927	.....	.....	23,852	$542,143
Ohio	21,261	594,268	.....	.....	16,875	415,651
Pennsylvania	167,165	4,901,446	.....	.....	118,759	3,505,236
West Virginia	4,344	113,443	.....	.....	9,443	308,383
All other	3,375	97,503	.....	.....	6,567	214,798
Total	203,681	5,940,587	150,926	$3,940,998	174,496	4,996,211

[1] Two-thirds were produced in Pennsylvania, one-fifth in Ohio, and the remainder in Indiana and Delaware. This statement is made, without figures, in Census of 1914.

[From "Federal Census," Census 1914.][1]

States.	1914	
	Quantity.	Value.
	Tons.	
California	27,554	.....
Illinois	79,929	.....
Indiana	164,299	.....
Kentucky	5,399	.....
Massachusetts	9,500	.....
Missouri	4,396	.....
New Jersey	32,913	.....
New York	61,405	.....
Ohio	140,932	.....
Pennsylvania	378,893	.....
All other	53,420	.....
Total	958,640	.....

[1] Made and consumed in same works.

Bar iron—Production in United States.

[From "Federal Census."][1]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1899	203,681	$5,940,587	1909	174,496	$4,986,215
1904	150,926	3,940,998	1914	108,483	2,967,815

[From 1918 Annual Statistical Report Am. I. & S. Inst.]

	Long tons.			*Long tons.*	
1905	1,322,429	$48,876,976	1914	563,171	$20,060,151
1909	952,230	37,536,907	1915	657,107	25,614,693
1910	1,074,163	44,513,315	1916	993,948	72,808,691
1911	835,625	30,700,863	1917	983,926	100,940,966
1912	944,790	37,035,768	1918	846,898	86,315,844
1913	1,026,632	44,155,442			

[1] Does not include that made and consumed in the producing establishments.

[From Annual Statistical Report, Am. I. & S. Inst., 1918, p. 36.[1]]

States.	1917	1918	States.	1917	1918
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*
Maine, Massachusetts	24,215	23,112	Ohio	192,418	169,499
Rhode Island, Connecticut	9,489	9,832	Indiana	306,504	204,535
New York	82,716	77,068	Illinois	175,526	139,108
New Jersey	40,543	30,108	Michigan, Wisconsin, Minnesota		3,766
Pennsylvania	793,551	688,310	Missouri, Oklahoma	112,265	89,385
Delaware, Virginia	27,058	22,889	Colorado, Utah, Washington	30,224	30,810
Maryland	2,511	2,055	California	16,842	19,906
West Virginia	1,642	5,241			
Texas, Kentucky, Tennessee, North Carolina, Georgia	51,229	50,786	Total	1,867,757	1,573,976
Alabama	1,022	4,579			

[1] These figures do not check against those of preceding table.

Bar iron—Production in principal foreign countries.

Great Britain:	Tons.
1889	2,225,000
1900	1,200,000
1907[1]	890,000
Germany:	
1889	1,650,000
1890	1,050,000
Canada:[2]	
1905	67,421
1906	78,898
1907	81,093
1908	65,505
1909	79,636
1910	83,918
1911	86,383
1912	109,012
Canada—Continued.	Tons.
1913	95,881
1914	47,269
1915	40,797
1916	76,478
1917	101,795
1918	96,296
Sweden:	
1916[3]	114,429
1917[3]	119,156
1887[4]	255,283
1886	237,120
1885	257,369
1884	264,944
1883	256,853

[1] Census of production 1907, iron bars 810,000, puddled bars, 80,000 tons.
[2] Finished Rolled Iron, Annual Statistics 1918, I. & S. Institute, p. 94.
[3] Iron blooms. Swedish Iron and Steel Industry, Report 1917.
[4] Wrought iron output reduced by shortage of raw materials. The Iron Trades Review, Jan. 10, 1919.

Bar iron—Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or rods, bars or shapes of rolled or hammered iron, n. s. p. f. (in sec. 103)—Imports, by countries.

[Fiscal years.]

Imported from—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Sweden	70,526,012	$1,213,904	61,332,316	$1,172,055	48,678,750	$914,206
United Kingdom	3,194,074	137,155	2,780,286	108,867	2,846,887	112,387
Belgium	1,304,340	14,682	2,342,417	32,872	1,253,305	19,239
Germany	1,072,948	14,133	1,112,033	17,206	146,244	2,689
All other	222,941	8,705	563,675	13,766	101,177	3,223
Total	76,320,315	1,388,579	68,130,727	1,344,766	53,026,363	1,051,744

Imported from—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Tons.*	
Sweden	61,646,941	$1,148,675	40,339,797	$843,737	7,877	$364,581
United Kingdom	5,154,117	205,367	1,258,466	51,361	265	22,943
Belgium	414,609	6,039	4,576,909	54,843	1,632	41,475
Germany	344,612	7,204	2,534,518	44,048	434	11,029
All other	16,096	1,663	266,440	7,349	76	3,818
Total	67,576,375	1,368,948	48,976,220	1,001,338	10,284	443,846

Imported from—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Sweden	7,565	$172,536	3,333	$322,174	1,060	$149,362
United Kingdom	358	28,150	135	14,832	761	59,771
Germany	125	9,099			12	306
Denmark			100	8,523		
Norway			102	10,770	50	8,710
Canada			607	37,773	647	51,513
Mexico			71	4,699	63	5,123
Cuba					2	20
Danish West Indies			32	723	1	384
All other	193	1,087				
Total	8,241	510,872	4,383	399,494	2,596	278,189

Bar iron—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910	$12 per ton	61,762,758	$41,591	$13,863.37	[1] $36.01	33.33
	$8 per ton		1,022,275	211,338.91	[1] 38.70	20.67
	¼ cent per pound	318,144	12,262	1,908.88		15.57
	⅓ cent per pound	5,995,899	170,347	17,987.71		10.56
	½ cent per pound	12,634	902	101.07	.071	11.20
	Total	68,089,435	1,247,377	215,199.94	.018	19.66
1911	$8 per ton	50,985,782	902,386	182,092.21	[1] 42.28	18.92
	¼ cent per pound	8,376,420	182,131	25,129.31		13.90
	½ cent per pound	1,526,432	26,916	9,158.60	.018	34.03
	Total	60,888,634	1,171,433	216,380.12	.019	18.47

[1] Per ton.

Bar iron—Imports for consumption—Revenue—Continued.

Fiscal year:	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compd ad valo rate
		Pounds.				*Per c*
1912	$8 per ton	39,494,694	$743,723	$141,052.52	[1] $42.18	
	⅛ cent per pound	9,769,328	245,464	29,308.00	.....	
	⅛ cent per pound	1,229,945	27,155	7,379.67	.022	
	Total	50,493,967	1,016,342	177,740.19	.020	
1913	$8 per ton	49,194,387	932,817	175,694.38	[1] 42.46	
	⅛ cent per pound	9,115,187	275,823	27,345.55	.....	
	⅛ cent per pound	1,310,773	28,526	7,864.64	.022	
	Total	59,620,347	1,237,166	210,904.57	.021	
1914	$8 per ton	21,571,200	96,675	17,083.60	[1] 45.27	
	5 per cent		347,250	17,362.50	[1] 46.33	
	⅛ cent per pound	240,327	10,994	720.98	.046	
	do	201,669	8,286	605.01	.041	
	⅛ cent per pound	51,466	1,245	308.79	.024	
	(Cons. and equip. free of vessels.)	4,592	80	.....	.017	.....
	5 per cent	10,812,874	202,111	10,105.55	.019	
	⅛ cent per pound	2,138,570	45,098	6,415.70	.021	
	5 per cent	5,352,844	91,228	4,561.40	.017	
	⅛ cent per pound	24,326	796	72.98	.033	
	Total	40,397,868	803,763	57,236.51	.020	
1915	5 per cent	11,923,520	225,198	11,259.90	.....	
	do	8,365,253	153,809	7,690.45	.....	
	do	3,046,446	60,160	3,008.00	.....	
	Total	23,335,219	439,167	21,958.35	.019	
1916	5 per cent	8,274,560	243,118	12,155.90	.....	
	do	5,866,682	172,427	8,621.35	.....	
	do	3,797,432	98,758	4,937.90	.....	
	do	987	64	3.20	.....	
	Total	17,939,661	514,367	25,718.35	.029	
1917	5 per cent	4,020,800	182,255	9,112.75	.....	
	do	1,857,061	101,923	5,096.15	.....	
	do	3,447,670	125,943	6,297.15	.....	
	do	3,879	91	4.55	.....	
	Total	9,329,410	410,212	20,510.60	.044	
1918	5 per cent	1,883,840	101,364	5,068.20	.....	
	do	1,430,417	123,692	6,184.60	.....	
	do	492,231	38,487	1,924.35	.....	
	Total	3,806,488	263,543	13,177.15	.....	

[1] Per ton.

Bar iron—Muck bars, bar iron, square iron, rolled or hammered, round iron, in coil rods, bars or shapes of rolled or hammered iron, n. s. p. f. (in sec. 103)—Dom exports.

[Fiscal years.]

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Valu
	Pounds.		*Pounds.*		*Pounds.*	
Canada	11,605,500	$216,228	22,315,599	$363,283	19,183,702	$30
Cuba	8,408,925	143,222	7,415,885	122,889	3,786,918	5
Argentina	4,287,087	74,138	2,542,638	53,673	2,777,471	4
Brazil	106,086	1,808	115,417	1,824	2,441,833	4
Mexico	1,847,010	38,527	2,185,879	42,917	1,842,689	3
Panama	666,497	15,727	651,020	13,001	404,838	
China	296,300	4,900	316,399	6,140	1,105,166	1
Japan			41,240	1,735	203,180	
Chile	6,315,399	105,983	2,493,364	40,869	.....	.....
All other	2,399,614	48,432	2,370,327	45,439	3,300,550	6
Total	35,931,418	648,965	40,451,028	691,770	35,046,347	57

i—Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or bars or shapes of rolled or hammered iron, n. s. p. f. (in sec. 103)—Domestic s—Continued.

xported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
	23,547,286	$429,181	13,088,347	$368,248	4,786,022	$81,766
	3,196,133	49,856	842,636	14,129	507,060	7,661
	3,302,656	57,845	1,192,435	21,656	8,221,335	118,193
	2,852,510	42,203	1,304,386	21,481	3,071,353	39,849
	3,082,269	57,131	826,968	18,608	1,112,822	26,718
	2,560,277	54,449	2,181,117	42,946	304,760	5,964
	2,670,987	53,476	897,121	21,116	3,468,033	49,352
	7,006,242	117,048	249,997	6,798	2,586,769	55,635
	204,652	3,344	190,231	2,726	23,925	320
					36,325	560
ngdom					508,368	6,913
s	231,761	3,546	14,725	276		
	2,003,884	111,329	1,281,949	44,148	3,025,280	53,215
l	51,426,996	925,562	23,071,912	502,132	27,652,278	446,146

cported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
	10,113,675	$220,944	18,763,713	$620,056	11,130,799	$533,983
	11,360,762	219,425	13,659,263	359,189	6,110,194	258,385
	19,656,032	310,143	22,861,926	629,461	8,195,672	341,358
	6,746,236	122,902	8,815,388	286,807	5,137,340	276,196
	1,015,559	30,846	1,480,920	64,303	2,035,245	111,997
	552,532	9,810	433,674	15,831	75,328	2,935
	399,103	8,750	2,759,248	84,077	1,154,369	52,538
	25,667,677	598,410	21,059,595	690,872	21,223,690	1,095,431
	1,796,238	33,342	6,681,758	212,162	7,682,842	356,833
			721,800	23,808	246,191	10,203
	13,209,862	270,133	4,605,351	137,665	3,361,071	161,992
	235,657	7,769	4,456,604	151,966	5,095,551	212,490
	8,406,399	152,170	5,053,239	119,265	2,354,794	98,069
ngdom	27,682,736	418,953	6,424,415	144,138	3,305,426	172,626
s	207,042	5,563	676,398	27,673	2,265,380	93,210
	30,224,865	647,960	26,425,745	2,719,351	32,955,439	1,607,493
l	157,964,375	3,052,120	144,889,017	4,386,623	112,539,425	5,435,658

Wrought in bars, rods, angles, and shapes and sections.

EXPORTS[1] OF THE UNITED KINGDOM.

	1913	1917
	Tons.	*Tons.*
	1,636	1,429
	2,273	2,546
ites	2,223	66
	2,360	1,101
	5,636	965
	6,942	2,206
ssessions	104,856	34,859
l	137,221	64,941

[1] Annual Statement of the Trade of the United Kingdom, 1917, p. 420.

Wrought in bars, rods, angles, and shapes and sections—Continued.

IMPORTS[1] OF THE UNITED KINGDOM—FREE OF DUTY.

	1913	1
	Tons.	T
Russia	325	
Sweden	52,188	
Germany	47,680	
Belgium	98,104	
France	226	
United States	519	
All other	933	
Total	199,975	

[1] Annual Statement of the Trade of the United Kingdom, 1917, p. 155.

EXPORTS OF GREAT BRITAIN.

The competitor for the foreign trade is Great Britain, whose exp in 1913 were 18,847 long tons to Spanish America, China, and Ja in which markets it would seem the United States should have advantage.

Prices and domestic imports and exports.

	Per 100 pounds.	Per ton, 2,240 pounds, Philadelphia.	Imports.	Ex
			Tons.	T
1872		$97.63		
1883	$2.25	50.30	47,409	
1884	2.00	44.65	40,998	
1885	1.80	40.32	35,251	
1886	1.85	43.12	32,647	
1887	2.15	49.37	40,565	
1888	2.20	44.90	35,553	
1889	1.94	43.40	29,570	
1890	2.05	45.92	24,034	
1891	1.90	42.56	18,099	
1892	1.87	41.81	19,282	
1893	1.80	38.08	14,896	
1894	1.55	29.96	9,228	
1895	1.20	32.29	20,049	
1896	1.46	31.36	12,276	
1897	1.40	29.40	13,264	
1898	1.40	28.65	19,119	
1899	1.12	46.29	19,791	
1900	2.50	44.00	19,685	
1901	1.75	41.16	20,792	
1902	2.13	47.79	28,844	
1903	2.00	44.83	43,398	
1904	1.72	38.49	20,911	
1905	1.92		37,294	
1906	1.98		35,793	
1907	2.11		39,746	
1908	1.70		19,671	
1909	1.76		19,206	
1910	1.85		38,231	
1911	1.64		26,729	

Merchant iron bars—Domestic production and consumption.

	1910	1913	1918
	Tons.	*Tons.*	*Tons.*
Production	1,074,163	1,026,632	846,898
Imports	2,815	4,908	380
	1,076,978	1,031,540	847,278
Exports	16,040	22,958	378
Consumption	1,060,938	1,008,582	846,900

Value of product at Philadelphia prices:

1910 ($1.85 per 100 pounds)	$44,519,314
1913 ($1.92)	44,153,387
1919 ($3.50)	67,809,403

Prices.

Kinds or grades.	1908	1909	1910	1911	1912	1913	1914
Iron bars:							
At Pittsburgh,[1] 100 pounds	$1.60	$1.62	$1.65	$1.41	$1.44	$1.69	$1.32
From store at Philadelphia, 100 pounds		1.76	1.85	1.64	1.75	1.92	1.59
Philadelphia[2]	1.47	1.40	1.53	1.30	1.38	1.59	1.27
Philadelphia[3]			1.85	1.64	1.75	1.92	1.60
Philadelphia,[4] best refined, 100 pounds	1.70	1.76	1.85	1.64			
Import prices,[4] 100 pounds	2.00	1.80	1.80	2.00	2.00	2.00	2.00

Kinds or grades.	1915	1916	1917	1918	1919
Iron bars:					
At Pittsburgh,[1] 100 pounds	$1.48	$2.14	$3.83	$4.31	
From store at Philadelphia	1.74	3.27	4.58	4.55	$3.470
Philadelphia[2]	1.32	2.59	4.09	3.50	
Philadelphia[3]	1.74				
Pittsburgh				3.50	3.50
Import prices, 100 pounds	1.90	2.80	4.10	4.80	
Swedish[5] (ton)				£52–£54	
English:					
For home use					£14 15s 0d
For export					20

[1] Annual statistics 1918. Am. I. & S. Inst.
[2] Metal statistics 1919. These figures are not correct evidently.
[3] Wholesale prices 1890–1915. Bulletin U. S. Bureau Labor Statistics, 200.
[4] Am. I. & S. Association statistics.
[5] Maximum price, Iron & Steel Traders Journal, Jan. 5, 1918.

Bar iron—Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or rods, bars or shapes of rolled or hammered iron, n. s. p. f. (par. 103)—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	.....	Bar iron, rolled or hammered, comprising flats, not less than one inch wide, nor less than three eighths of an inch thick.	0.8 cent per pound.
		Comprising round iron not less than three fourths of one inch in diameter, and square iron not less than three-fourths of one inch square.	1 cent per pound.
		Comprising flats less than one inch wide or less than three eighths of one inch thick; round iron less than three fourths of one inch and not less than seventeenths of one inch in diameter, and square iron less than three fourths of one inch square * * *	1.1 cents per pound.
		Provided further, That all iron bars, blooms, billets, or sizes or shapes of any kind, in the manufacture of which charcoal is used as fuel, shall be subject to a duty of.	$22 per ton.
1890	135	Bar iron, rolled or hammered, comprising flats not less than one inch wide, nor less than three eighths of one inch thick.	0.8 cent per pound.
		Round iron not less than three fourths of one inch in diameter, and square iron not less than three fourths of one inch square.	0.9 cent per pound.
		Flats less than one inch wide, or less than three eighths of one inch thick, round iron less than three-fourths of one inch * * * in diameter; and square iron less than three-fourths of one inch square.	1 cent per pound.
	136	* * * *Provided further*, That all iron bars, blooms, billets, or sizes or shapes of any kind, in the manufacture of which charcoal is used as fuel, shall be subject to a duty of not less than.	$22 per ton.

Bar iron—Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or rods, bars or shapes of rolled or hammered iron, n. s. p. f. (par. 103)—Rates of duty—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1894	111	* * * *Provided further*, That all iron bars, blooms, billets, or sizes or shapes of any kind, in the manufacture of which charcoal is used as fuel, shall be subject to a duty of.	$12 per ton.
	112	Bar iron, rolled and hammered, comprising flats not less than one inch wide nor less than three-eighths of one inch thick.	0.6 cent per pound.
		Round iron not less than three-fourths of one inch in diameter, and square iron not less than three-fourths of one inch square.	0.6 cent per pound.
		Flats less than one inch wide, or less than three-eighths of one inch thick; round iron less than three-fourths of one inch and not less than seven-sixteenths of one inch in diameter; and square iron less than three-fourths of one inch square.	0.6 cent per pound.
1897	123	Bar iron, square iron, rolled or hammered, comprising flats not less than one inch wide nor less than three-eighths of one inch thick, round iron not less than seven-sixteenths of one inch in diameter.	0.6 cent per pound.
1909	119	Bar iron, muck bars, square iron, rolled or hammered, comprising flats not less than one inch wide nor less than three-eighths of one inch thick, round iron not less than seven-sixteenths of one inch in diameter.	0.3 cent per pound.
	120	* * * *Provided further*, That all iron bars, blooms, billets, slabs or loops, in the manufacture of which charcoal is used as fuel, shall be subject to a duty of.	$8 per ton.
1913	103	Muck bars, bar iron, square iron, rolled or hammered, round iron, in coils or rods, bars or shapes of rolled or hammered iron not specially provided for in this section.	5 per cent ad valorem.

Court and Treasury Decisions.

Musk bars produced by converting pig iron into nut iron in the puddling furnace and then rolling the nut iron through a set of rollers were held dutiable under paragraph 123 of the act of 1897 as "bar iron," and not under the first proviso in paragraph 125 for "iron in forms less finished than iron bars and more advanced than pig iron." (Moorhead *v.* United States, 127 Fed., 779.)

The words "bar iron" in paragraph 123 of the act of 1897 and the words "iron bars" in paragraph 124 were taken to mean the same thing in the absence of evidence showing that the terms were distinguished in commerce, and "iron bars" made by the charcoal process were held to be included in the last proviso of paragraph 124.

The proviso to paragraph 124 of the act of 1897 was held limited in its operation to the paragraph itself, and only such classes of iron as those provided for in the paragraph which might be manufactured with the use of charcoal as a fuel. (G. A. 4834, T. D. 22708.)

Musk bars made by the charcoal process were held not included in the last proviso to the paragraph 120 of the act of 1909, but dutiable under the eo nomine provision for such merchandise in paragraph 119. The last proviso to paragraph 120 was limited to such articles as are provided for in that paragraph. (G. A. 7205, T. D. 31494.)

Rod bar iron in 10-foot lengths and one-fourth, three-eighths, and one-half inch in diameter, recognized in commerce as bar iron and not as wire rods was held dutiable under paragraph 103, rather than paragraph 113 of the act of 1913. (Abstract 39871; followed in Abstracts 40239, and 40372 which, however, do not specify dimensions.) But rod iron, rods in coils such as iron wire rods were held dutiable under paragraph 113 as iron wire rods, and not under para-

graph 103 as rod iron in coils. (Swedish Iron and Steel Corporation *v.* United States, 6 Ct. Cust. Appls., 225.) The court distinguished Athenia Steel and Wire Company *v.* United States, 1 Ct. Cust. Appls., 494, wherein it was held that steel in the form of bands or strips about 3 inches wide, one-eighth of an inch thick, and 30 feet or over in length imported in coils was dutiable under the provisions for "steel in all forms and shapes n. s. p. f." under paragraph 135 of the act of 1897, and not under the provision of that act for wire rods.

O

UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 104 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

STRUCTURAL SHAPES

REVISED EDITION

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UNITED STATES TARIFF COMMISSION.

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V

PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and Index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of Abraham Berglund of the Metals Division of the Commission's staff, and of others.

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STRUCTURAL SHAPES.

SUMMARY.

Description.—The term structural shapes is applied to iron and steel forms which have been rolled for strictly structural purposes. Structural shapes vary in size, weight, and form, according to the uses to which they are to be put, but they are broadly classified into heavy and light. Those classified as heavy have a leg or web of 3 inches or over and are used in the construction of buildings, bridges, cars, ships, etc. Light structural shapes have a leg or web less than 3 inches and are used in the manufacture of agricultural implements, bedsteads, fences, safes, automobiles, and other articles requiring light section.

Domestic production and consumption.—During the years 1910 to 1919, inclusive, the domestic production per annum has varied from 1,912,367 gross tons in 1911 to 3,110,000 gross tons in 1917. About 90 per cent of the country's output consists of heavy shapes. The consumption is about 85 to 95 per cent of the domestic production. Just prior to the war there was a marked tendency for exports to increase.

Imports.—Imports are less than 1 per cent of the home production. Since 1915 Canada has been the leading contributor of the foreign supply, but during the years immediately preceding the outbreak of hostilities in Europe the greater part of the imported material came from Germany. During the years 1910–1915 over half the imported structural shapes entered the United States through the customs districts of the Pacific coast, from a third to over a half entering through the customs district of San Francisco.

Tariff.—Prior to the act of 1913, specific duties were imposed on imported iron and steel beams, girders, etc. During the preceding 30 years these duties were gradually reduced from 1¼ cents to three-tenths and four-tenths cent per pound, depending on value. The law of 1913 imposed an ad valorem duty of 10 per cent, which, with the price then prevailing, was equivalent to a 60 per cent reduction in rates from those imposed by the act of 1909. The high prices resulting from the war, however, have made this ad valorem duty nearly equivalent to the specific duties imposed by the law of 1909.

At the present time (1921) American producers have almost entire control of the home market and are able to export from 5 to 15 per cent of the country's output. For several years, however, European producers were able to market this product on the Pacific coast, the cost of transporting structural shapes from Europe to the Pacific coast being less than the cost of shipping the domestic product from Pittsburgh by rail across the continent. The war in Europe, however, brought about a lessened importation of structural shapes, and the high ocean freight rates have largely done away with any competitive advantage which foreign producers may have had with reference to cheaper transportation rates to the Pacific coast.

The level of duties in certain foreign countries is greater than that in the present American tariff. In France duties in the general tariff range from $0.50 to $1.31 per 100 pounds, and in Austria-Hungary

and Russia they are still higher. Canada imposes ad valorem rates ranging from 27 per cent (British preferential tariff) to 42½ per cent (general tariff). On the other hand, lower rates have prevailed in Belgium (before the war) and in Japan.

Structural shapes—Summary table.

Year.	Domestic production. (See Note)	Imports for consumption (See Note)	Domestic exports.	Ratio to production.		Value (imports for consumption).	Amount of duty.	Value per gross ton.	Equivalent ad valorem rate (per cent).
				Imports.	Exports.				
	Gross tons.	*Gross tons.*	*Gr. tons.*	*Per cent.*	*Per cent.*				
1910	2,266,890	10,900.71	120,228	0.48	5.30	$323,363.00	$99,613.53	29.67	30.81
1911	1,912,367	11,119.31	176,095	.58	9.21	325,018.00	99,326.86	29.23	30.56
1912	2,846,487	4,158.13	251,535	.15	8.84	160,504.36	37,243.92	38.68	23.20
1913	3,004,972	6,738.26	366,654	.22	12.20	245,156.00	58,166.94	36.38	[1] 24.70
1914	2,031,124	11,897.23	296,282	.59	14.59	419,348.80	59,490.57	35.25	[1] 14.32
1915	2,437,003	5,019.95	168,664	.21	6.92	214,295.00	21,429.50	42.69	10.00
1916	3,029,964	1,543.99	270,311	.05	8.92	176,022.00	17,602.20	114.00	10.00
1917	3,110,000	821.46	339,486	.02	10.92	131,429.00	12,345.80	160.01	9.39
1918	2,849,959	7,288.89	240,384	.26	8.43	852,017.00	84,736.80	116.89	9.95
1918[2]	2,849,969	24,026.31	232,729	.84	8.17	2,826,627.00	39,490.00	117.65	13.97
1919[2]	2,614,036	15,587.61	360,787	.59	13.80	2,012,688.00	13,167.00	129.12	6.54
1920[2]		1,741.88	493,655			307,685.00	28,417.00	176.63	9.24

[1] The ad valorem rate is calculated in percentages for structural shapes bearing duty. In the years 1913 and 1914, structural shapes to the value of $9,666 in 1913, and $3,776 in 1914 were admitted free.
[2] Calendar years.
NOTE.—The figures for domestic production are for calendar years; the other figures are for fiscal years.

GENERAL INFORMATION.

DESCRIPTION.

Structural shapes are iron or steel shapes which are rolled for strictly structural purposes. They are classified into heavy and light, the former being those with the leg or web 3 inches or over, and the light, those with the leg or web less than 3 inches. Heavy structural shapes are used in the construction of buildings, bridges, cars, etc., and constitute over 90 per cent of the country's total tonnage of structural shapes. Light shapes are used in the manufacture of agricultural implements, bedsteads, fences, safes, automobiles, and other articles requiring members of light section.

Within the two classes named structural shapes vary in size, weight, and form, depending upon the use to which they are to be put. Some of the most common are given the commercial names of I beams, channels, angles, tees, and zees.

DOMESTIC PRODUCTION.

Quantity produced and consumed.—During the years 1910 to 1919, inclusive, the domestic production of structural shapes varied from 1,912,367 gross tons in 1911 to 3,110,000 gross tons in 1917. The amount consumed during the same period in this country was appreciably less, varying from 1,694,217 gross tons in 1911 to 2,822,066 gross tons in 1917. Our domestic exports exceeded our imports for consumption. (P. 11.)

Raw material and process of production.—The raw material for the production of structural shapes consists of open-hearth and Bessemer steel, the former being by far the more important. An insignificant fraction of these shapes (less than 0.03 per cent of the total in 1919) is made of iron. Heavy structural shapes, I beams and channels, are usually rolled, often in one heat, from ingots or blooms to finished

material, and the lighter shapes, angles, tees, and zees, from large billets. The heaviest shapes are rolled in beam mills and lighter shapes in shape mills.

After leaving the rolling mills, shapes are cut to length, cooled, and straightened. They are then further developed at shops specially adapted to carrying out the character of the work for which they are intended—products designed for building construction being further fabricated in architectural iron works; bridge forms, in bridge works; ship material, in shipyards; and railroad products, in car shops.

According to figures published in 1913 in the Report of the Commissioner of Corporations on the Steel Industry, the average book cost of producing structural shapes from ingots during the years 1902–1906 amounted to $26.52 per gross ton, and from large billets to $27.76. In 1910 the mill cost of producing heavy structural shapes by the United States Steel Corporation was computed at $20.80 per gross ton. In the process of manufacturing heavy structural shapes the labor cost constituted from 34 to nearly 50 per cent of the total conversion cost. Present (1921) costs are much higher. It is probable, however, that the labor item involved in conversion remains proportionately the same as under the earlier costs, because processes of manufacture have not materially changed.

Localities of production and integration.—According to the Census Report on Manufactures, Iron and Steel, for 1914, there were in the United States that year 35 establishments producing structural shapes. Of that number 18 were located in Pennsylvania, 4 in Ohio, 4 in Indiana, and 3 in Illinois, making 29 out of 35 for the States named. Of the tonnage produced in 1914, 72 per cent was produced in Pennsylvania. In Ohio the production of light shapes exceeded that of heavy shapes, but in the other States named the production of heavy shapes was far in excess.

The tendency toward integration is marked in the manufacture of structural shapes as in other branches of iron and steel production. The United States Steel Corporation controls approximately one-half the output of the country. (P. 11.)

Exports.—The domestic exports of structural shapes during the years 1910–1917 have varied from 120,228 gross tons in 1910 to 366,654 gross tons in 1913. During the first seven of these years the exports constituted 5 to 15 per cent of the total domestic production. Of the exported product over half goes to Canada. The remainder goes mainly to Cuba and other parts of Latin America and to Japan and Australia.

Industrial uses.—The steel from which heavy structural shapes are rolled is prepared to conform to three kinds of specifications, namely, buildings, bridges, and ships. A considerable amount of structural steel is used in the manufacture of railroad cars. The utilization of structural steel for shipbuilding has increased in late years. The Iron Trade Review makes the following statement: "Perhaps the most revolutionary development in the steel industry in 1917 was the extensive application of structural shapes to the building of ships. When shipbuilding was taken in hand by the Government, as the one of all instruments essential in winning the war, old-time methods and the supply of ship shapes were found utterly incapable of coping with the situation. To meet the emergency structural mills and fabricating shops were called upon to furnish hugh tonnages. The practicability of this departure already has been demonstrated

thoroughly, and indications are that the standardized, or fabr steel vessel permanently will be a portion of the field served structural industry." [1]

History.—The wide use of structural shapes made of steel i recent. After the Civil War the first great demand for the ne cheaper steel resulting from the introduction of the Bessemer p was the demand for rails. This demand was followed by the t tion of steel for bridges, buildings, and ships. In 1901 the p tion of structural shapes made of iron and steel for the first t the United States exceeded 1,000,000 tons; in 1906, 2,000,00(and in 1913, 3,000,000 tons.

Production of structural shapes according to material.—The p tion of structural shapes, as indicated in the Census reports for 1904, and 1909, is given in the following tabulation, showin material used in iron, Bessemer steel, or open-hearth steel: [2]

Material.	Gross tons.	
1899.		
Total	856,983	$2
Total steel	829,892	2
Open-hearth steel	566,092	1
Bessemer steel	263,800	
Iron	27,091	
1904.		
Total	954,537	3
Total steel	950,062	3
Open-hearth steel	618,391	2
Bessemer steel	331,671	1
Iron	4,475	
1909.		
Total	2,123,630	6
Total steel	2,102,300	6
Open-hearth steel	1,934,230	5
Bessemer steel	168,070	
Iron	21,330	

The above figures give some indication of the relative impor of iron and steel in the manufacture of structural shapes and great and increasing importance of open-hearth over Bessemer

The relative importance of iron and steel in the manufact structural shapes for the years 1910–1916 is indicated as follow

Year.	Iron.	Steel.	
	Gross tons.	*Gross tons.*	*Gr*
1910	426	2,266,464	2
1911	811	1,911,556	1
1912	5,517	2,840,970	2
1913	3,841	3,001,131	3
1914	1,981	2,029,143	2
1915	1,858	2,435,145	2
1916	1,823	3,028,141	3
1917	1,410	3,108,590	3
1918	774	2,849,195	2
1919	770	2,613,266	2

[1] Iron Trade Review, Jan. 3, 1918, p. 34.
[2] United States Census, 1910, Vol. X, p. 238.
[3] Annual Statistical Report of the American Iron and Steel Institute, 1916, p. 42.

Percentages of total rolled products and forgings.—During the years 1899, 1904, 1909, and 1914, for which the Census published reports on the amounts and values of manufactured iron and steel, structural shapes constituted the following percentages of the total tonnages of finished rolled products and forgings: [1]

	Per cent of total.
1899	8.2
1904	7.5
1909	11.0
1914	8.2

Consumption of structural shapes in the United States, 1910–1916.—The approximate consumption of a commodity in the United States is determined by adding the amounts produced and imported, and subtracting exports. In the case of structural shapes, domestic production exceeds consumption as indicated in the following tabulation:

Calendar year.	Domestic production.	Add imports.	Deduct exports.	Consumption.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*
1910	2,266,890	14,897	146,721	2,135,066
1911	1,912,367	5,343	223,493	1,694,217
1912	2,846,487	3,120	288,164	2,561,443
1913	3,004,972	11,659	403,264	2,613,367
1914	2,031,124	10,145	182,395	1,858,874
1915	2,437,003	1,494	232,139	2,206,358
1916	3,029,964	1,473	300,594	2,730,843
1917	3,110,000	6,216	294,150	2,822,066
1918	2,849,969	3,504	232,729	2,620,744
1919	2,614,039	1,154	360,787	2,254,403

Proportion of production controlled by the United States Steel Corporation.—As in other lines of steel manufacture, the position of the United States Steel Corporation is a dominant one in the production of structural shapes. The percentage of control is somewhat less than in the cases of rails, tin plate, and wire rods. The proportion of the country's output controlled by the United States Steel Corporation is nearly one-half. The figures for the amounts produced by the Steel Corporation and independents are given below: [2]

Year.	By United States Steel Corporation.	By independent companies.	Total product.	Percentage, United States Steel Corporation.
	Gross tons.	*Gross tons.*	*Gross tons.*	
1909	753,481	546,845	1,300,326	57.90
1910	1,163,300	1,103,590	2,266,890	51.30
1911	898,466	1,013,901	1,912,367	47.00
1912	1,418,518	1,427,969	2,846,487	49.83
1913	1,623,669	1,381,303	3,004,972	54.03
1914	965,208	1,065,916	2,031,124	47.52
1915	1,124,532	1,312,471	2,437,003	46.14
1916	1,495,752	1,534,212	3,029,964	49.37
1917	1,489,081	1,620,919	3,110,000	47.88
1918	1,379,720	1,470,249	2,849,969	48.41
1919	1,144,165	1,469,871	2,614,036	43.77

The above figures show that while the proportion of the country's output controlled by the United States Steel Corporation is large, it

[1] United States Census, 1910, Vol. X, p. 40, and Census of Manufactures, 1914, Iron and Steel, p. 44.
[2] Annual Statistical Reports of the American Iron and Steel Association and of the American Iron and Steel Institute.

has been less in recent years than at the end of the year for w the corporation published its first annual report to stockhol (1902).

Costs of manufacture.—The Bureau of Corporations made a vestigation of the cost of producing various iron and steel comm ties in the United States for the years 1902 to 1906, inclusive. investigation was also made of the costs of manufacture by United States Steel Corporation for 1910. These investigat covered, among other commodities, the cost of manufacturing st tural shapes. The results are tabulated as follows: [1]

Average book cost of structural shapes from ingots, 1902–1906.

Gross tons produced by companies investigated	1,72
	Avera per
Ingots	$
Labor	
Fuel	
Steam	
Rolls	
Materials in repairs and maintenance	
Supplies and tools	
Miscellaneous and general works expense	
Mill cost	
Additional cost:	
General and miscellaneous expense	
Depreciation	
Total book cost	
Price of ingots used	$
Pounds of ingots used	
Price of scrap recovered	$
Pounds of scrap recovered	
Net cost of waste	

The average book cost of structural shapes manufactured f large billets, amounted to $27.76 per gross ton, the higher fi being due in the main to the higher cost of large billets.

Steel Corporation's mill cost per gross ton of heavy structural shapes in 1910.

Item.	Company or book cost.	Inter-company profit (approximate).	Integ cost e sive o retu inves on any rior st produ or tr porta
Blooms	$20.94	$3.75	
Labor	1.77		
Fuel	.19		
Steam	.43	.01	
Rolls	.34	.01	
Materials in repairs and maintenance	.30		
Supplies and expense	.60		
Mill cost	24.57	3.77	
Price of blooms used	$19.59	$3.61	
Pounds of blooms used	2,653		
Price of scrap recovered	$13.01	$3.03	
Pounds of scrap recovered	388		
Net cost of waste	$1.35	$0.14	

[1] Report of Commissioner of Corporations in the Steel Industry, Pt. III, pp. 225–227, 476–477.

It will be observed that the mill cost for the United States Steel Corporation in 1910 was lower than the average cost for the plants investigated for the years 1902–1906.

FOREIGN PRODUCTION.

Great Britain and Germany are large producers of structural shapes. In the latter country in 1913 the manufacture of girders alone amounted to over 1,500,000 metric tons. After the outbreak of war, in 1914, production declined. In England in 1913 the British Joist Makers' Association reported a production by their members of 282,000 tons of joists. Other countries manufacturing structural shapes in considerable amounts are France, Belgium, and Canada.

IMPORTS.

Quantity.—The importation of structural shapes averages considerably less than 1 per cent of the country's output. The annual imports for consumption during the years 1910–1916 reached their maximum in the fiscal year 1914, when they amounted to 11,897 gross tons, or 0.59 per cent of the domestic production. After the outbreak of the war imports declined, and in 1917 amounted to only 1,021 tons (2,286,940 pounds), the imports for consumption being 772 tons.

Contributing countries.—From 1910 to 1914 from half to three-quarters of the total imports came from Germany. Other countries furnishing us with imported material were Belgium, France, and the United Kingdom. During the years 1916 and 1917 the principal contributing countries were Canada, England, and Sweden.

Destination.—From 1910 to 1915, inclusive, over half the imported structural shapes entered the United States through the customs districts of the Pacific coast, San Francisco alone having 34 to 57 per cent of this trade. The predominance of the Pacific coast can be explained on the ground that this region of the country found the imported material much cheaper than the domestic product, the cost of shipping structural steel from Europe by water to the Pacific coast being considerably less than the cost of transporting similar material by rail from steel-producing centers of the country to the same destination. Since 1915 the rise in ocean freight rates, as well as other changes brought about in the world trade by the war in Europe, has greatly reduced the importation of structural shapes on the Pacific coast.

Revenue.—From 1907 to 1917 the annual revenue derived from the importation of structural shapes has varied from $172,000 in 1907 to $12,345 in 1917, the figure for 1917 being due to the greatly reduced importations on account of the war. During the eight fiscal years immediately preceding the war (1907–1914) the duties collected averaged $75,400 per annum. The amount per year, however, shows great variation, depending upon general business conditions and the consequent demand for structural material. How far the reduction of duty under the tariff of 1913 affected the revenue is difficult to determine in view of the outbreak of war in Europe shortly after the act went into operation.

Imports by customs districts.—Before the war in Europe a large proportion of the imported structural shapes entered the United States

through customs districts on the Pacific coast. In the year 1 (fiscal) over half the imported material came through the cust district of San Francisco. As water transportation from Europe much lower than rail transportation from the leading steel manuf turing centers in this country, much of the structural material u on the Pacific coast was imported. (See p. 17.) Since 1915 Pacific coast has figured less prominently in the import trade structural material. The following table shows the imports by c toms districts for the years 1910 and 1912–1917.[1]

Years.	Custom districts.	Pounds.	Value.	Years.	Custom districts.	Pounds.	Va
1910	All districts	23,877,101	$315,502	1915	All districts	12,408,159	$22
	San Francisco	9,952,172	103,354		San Francisco	4,742,906	5
	New York	3,940,269	77,182		Southern California	2,372,317	2
	Puget Sound	3,582,011	35,541		New York	2,037,444	9
	Willamette, Oreg	3,042,753	30,006		Oregon	958,266	
	Chicago	1,036,935	38,887		Chicago	778,878	1
1912	All districts	6,413,954	123,642	1916	All districts	3,542,477	17
	New York	2,332,343	61,900		New York	1,304,053	10
	San Francisco	2,213,038	23,818		Washington	659,744	1
	Puget Sound	718,227	7,914		Michican	635,635	2
	Chicago	645,226	20,538		Chicago	537,032	1
	Philadelphia	164,077	2,936		Virginia	180,859	
	Genesee, N. Y	114,999	2,025		Duluth-Superior	56,302	
1913	All districts	17,931,947	277,374		Philadelphia	47,692	
	San Francisco	10,238,224	110,732		San Francisco	35,000	
	New York	3,268,045	75,230	1917	All districts	2,286,940	15
	Portland, Oreg	1,118,810	13,315		New York	927,974	9
	Chicago	986,472	32,680		Michican	421,893	2
1914	All districts	24,710,120	378,420		Buffalo	379,925	1
	San Francisco	11,337,402	131,253		Galveston	238,542	
	New York	3,568,923	111,660		Washington	120,949	
	Massachusetts	2,712,326	25,959		St. Lawrence	82,193	
	Oregon	2,703,477	29,650	1918	All districts	16,309,322	84
	Washington	1,471,539	18,406		Maryland	2,383,198	17
	Chicago	1,082,598	31,095		Buffalo	5,322,342	29
	Philadelphia	1,080,679	17,386		Galveston	3,124,082	10
					Chicago	1,623,563	6

It will be observed that in the years 1910, 1913, 1914, and 1 over half of the imported structural material came through custo districts on the Pacific coast, and in 1912 the proportion was nea half. In the calendar year 1919 out of a total importation 2,585,517 pounds 1,474,552 pounds entered the country through customs district of Michigan and 314,949 pounds through that St. Lawrence. Only 19,567 pounds entered by way of the Pac coast.

PRICES.

The price of structural shapes is usually quoted in cents per pou Pittsburgh, Pa., the price in other regions of the country being Pittsburgh price plus the cost of transportation. Late in 1899 a early in 1900 the Pittsburgh quotation for I beams was 2.25 ce per pound, which was regarded as high. In December, 1914, price was 1.07 cents. Two years later, when the war was making influence felt on iron and steel prices in the United States, quotati rose to 3.25 cents, and in July, 1917, it was 4.50 cents. From Oc ber, 1917, to December, 1918, a price fixed under Government sup

[1] The imports of structural shapes for the year 1911 are not separately reported in table for cus districts in Commercial Navigation.

vision, 3 cents per pound, Pittsburgh, prevailed. Early in April, 1920, a price of 3.25 cents was quoted, but a year later it had fallen to 2.00 cents.

TARIFF HISTORY.

Paragraph 104 of the tariff act of 1913 imposes a 10 per cent ad valorem duty on "beams, girders, joists, angles, channels, car-truck channels, T T, columns and posts or parts or sections of columns and posts, deck and bulb beams, sashes, frames, and building forms, together with all other structural shapes of iron or steel, whether plain, punched, or fitted for use, or whether assembled or manufactured." With the prices prevailing at the time this law went into effect this duty was practically a reduction of 60 per cent in the duties prevailing under the act of 1909. With present (1921) prices, however, the duties imposed in the acts of 1913 and 1909 are very nearly the same.

Prior to the tariff act of 1913 specific duties were impoosed on imported iron and steel beams, girders, etc., the tendency being toward a gradual reduction of duty. In the act of 1883 the duty was 1¼ cents per pound; in 1890, nine-tenths cent; in 1894, six-tenths cent; in 1897, five-tenths cent; and in 1909, three-tenths and four-tenths cent, depending upon value.

Duties on structural shapes in foreign countries exhibit considerable variation. Canada imposes ad valorem duties ranging from 27 per cent (British preferential tariff) to 42½ per cent (general tariff). In France duties range, in the case of the general tariff, from $0.50 to $1.31 per 100 pounds. The minimum tariff is from 25 to 33⅓ per cent less. The Austrian-Hungarian territories impose a duty of $1.57 per 100 pounds in their general tariff and $1.38 in their conventional tariff. The duties in Russia range still higher, from $1.41 to $2.40 per 100 pounds. These tariffs, on the whole, range considerably higher than those of the United States. The duties imposed by Belgium (before the war) and Japan are lower than those mentioned, and on the basis of prices prevailing since the armistice, less than those of this country.

COMPETITIVE CONDITIONS.

The United States manufactures structural steel in probably larger amounts than any other country. Her exports are also considerable, while imports are small. Under the present tariff the industry of manufacturing structural steel is protected by an ad valorem duty of 10 per cent. Prior to the enactment of this tariff specific duties of a highly protective character were imposed on the imported article. Canada, which has a preferential tariff in favor of English steel, received a larger proportion of the American exported structural shapes than any other country. In 1908 Mr. Willis L. King, of the Jones & Laughlin Steel Co., testified before the House Committee on Ways and Means that his company was exporting structural shapes to Canada, notwithstanding the tariff preference in favor of the English product.[1] This export trade, too, was apparently not done without profit.[2]

[1] Tariff Hearings, Committee on Ways and Means, 60th Cong., p. 1966 (1908–9). [2] Ibid.

American and foreign costs.—Although our export trade in structural shapes has been large enough to show considerable competitive strength in foreign markets, American manufacturers have contended that protective duties are necessary in order to maintain their industry in a prosperous condition. Mr. King, of the Jones & Laughlin Steel Co., maintained before the Committee on Ways and Means in 1908 that steel could be produced more cheaply in England, Belgium, and Germany than in the United States. A comparison between German and Belgian costs, on the one hand, and American costs, on the other, as represented by Mr. King, was as follows:[1]

Cost of producing steel in Germany and Belgium.

	Per gross ton.
Pig iron	$8.50
Converting pig iron into billets	4.00
Converting billets into finished steel (plates and structural steel)	5.00
Freight on finished material from foreign mills to New York	3.00
Add present (1908) duty on steel bars	6.72
Total cost on docks at our seaboard	27.22

Cost of producing steel in Pittsburgh, at works of Jones & Laughlin Steel Co., in 1907.

	Per gross ton.
Pig iron	$15.41
Converting same into billets	7.09
Converting billets into finished steel (plates and structural shapes)	8.06
	30.56
Add freight to New York	3.58
Total	34.14

The cost to the Jones & Laughlin Steel Co. was divided into the following items:

	Per gross ton.
Transportation (raw materials, $8.12; finished to New York, $3.58)	$11.70
Labor	9.00
Materials, taxes, administration, selling cost, and depreciation	13.44
Total	34.14

According to these figures the cost to the German and Belgian producers of selling finished steel in the form of plates and structural shapes in New York City amounted to $1.21 per 100 pounds, while to the Jones & Laughlin Steel Co. the corresponding cost was $1.54 per 100 pounds.

The Pittsburgh quotations for structural steel during 1908 and 1909, when hearings before the House Committee on Ways and Means were held preliminary to the enactment of the tariff of 1909, varied from $1.70 to $1.25 per 100 pounds. These quotations were probably somewhat above actual prices. The lowest of these quotations would not cover costs to the Jones & Laughlin Steel Co., as given above, and the still lower prices prevailing in the winter of 1911–12 and during

[1] Tariff Hearings, 60th Cong., pp. 1085–1086 (1908–9).

the year 1914 would make the disparity still greater. Yet during these periods of low prices American exports of structural shapes were large and apparently profitable.

A comparison of the prices of foreign and domestic structural steel delivered in New York and Boston, as given in Mr. King's testimony before the Committee on Ways and Means, Sixtieth Congress, is as follows:

Comparison of prices [1] *in 1908 and 1909 of foreign and domestic structural steel, delivered f. o. b. in New York and Boston (in cents per pound).*

	New York.	Boston.		New York.	Boston.
Continental price, duty paid	1.63	1.63	Scotch price, duty paid	1.72	1.72
English price, duty paid	1.88	1.88	American price	1.76	1.78

[1] Tariff hearings before Committee on Ways and Means, 1908–9, Vol. II, pp. 1986 and 1987.

The continental price (German and Belgium) was materially lower than the American price at New York, whereas the English price after paying the duty under the tariff of 1897, which was still in operation, was considerably higher.

Price comparisons of this nature are of little value unless the character and quality of the commodity is clearly shown. American structural steel is better designed than most foreign shapes. A given tonnage of American structural material will generally go further than foreign makes, and is often preferred to the latter, even when the price is appreciably higher.

The Federal Trade Commission in the determination of the costs of iron and steel products during the war for the use of the price-fixing committee of the War Industries Board and of certain purchasing departments of the Government obtained the monthly cost sheets of the producing companies showing the average mill cost of producing structural shapes from October, 1917, to December, 1918, inclusive. These cost sheets were for mill costs and did not cover general and administrative expenses or general depreciation. At the request of the Tariff Commission for information respecting the proportion of the various items of cost to the mill cost, the Federal Trade Commission compiled the costs as reported by five representative companies. They did not, of course, include any items for interest or for income or excess profits taxes. If the additional costs for general and administrative expenses and for general depreciation could be determined with accuracy, there would be a substantial addition to the mill cost as shown below.

These data have not as yet been published by the Federal Trade Commission and were furnished to the Tariff Commission with the statement that they were subject to revision. While these figures give the reported mill costs for only five companies, it is believed that they are sufficiently representative to show the relative importance

of the particular items entering into mill costs. For quart periods these costs were as follows:

Average cost f. o. b. mill of structural shapes, exclusive of general and administrative exp and depreciation, of five representative companies, by quarters, for the period Oct 1917, to December, 1918.

Item of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	Oct to cem
Production (gross tons)	634,584	598,476	722,743	789,927	8
Net metal	$37.54	$39.34	$39.06	$41.78	
Fuel	.48	.66	.60	.56	
Labor	2.38	2.66	2.81	3.07	
Maintenance and repairs	1.05	1.05	1.09	1.17	
Rolls	.55	.56	.58	.66	
Steam and power	.91	1.14	1.04	1.01	
Rebuilding and contingent	.06	.06	.06	.06	
Other costs	.75	.85	.78	.86	
Mill cost	43.72	46.32	46.02	49.17	

Percentage of all mill costs.

Item of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	Oct to cem
Net metal	85.86	84.93	84.88	84.97	
Fuel	1.10	1.42	1.30	1.14	
Labor	5.44	5.74	6.11	6.24	
Maintenance and repairs	2.40	2.27	2.37	2.38	
Rolls	1.26	1.21	1.26	1.34	
Steam and power	2.08	2.46	2.26	2.06	
Rebuilding and contingent	.14	.13	.13	.12	
Other costs	1.72	1.84	1.69	1.75	
Mill cost	100.00	100.00	100.00	100.00	1

Transportation costs.—The possibility of meeting foreign com tition in different parts of the country is intimately related to relat costs of transporting articles from the place of manufacture to c suming points. Water transportation is cheaper than rail, and the case of a heavy bulky commodity like structural steel this i matter of importance. Before the war ocean freights from west Europe to American ports were materially lower than the rail ra from Pittsburgh to the corresponding points, as shown below:

Foreign freight rates to Pacific seaports and domestic rail rates to the same ports.[1]

[In carload lots, cents per 100 pounds.]

From Antwerp, Liverpool, Hamburg, Newcastle, Bremen, London, Hull, and Southampton to—				From Pittsburgh to—
	San Francisco, San Diego, Seattle, Tacoma.	Portland and East Portland.	Los Angeles (by rail from San Diego).	San Francisco, Seattle, Tacoma, Los Angeles, Portland, and East Portland.
Angles	40	55	50	80 cents, all rail; 71 cents via New York and water to California points.
Iron beams, joists, and girders	43	58	53	76 cents to Oregon points via New York and water.
Channels	40	55	50	
Columns and base plates	43	58	53	

[1] Tariff hearings before Committee on Ways and Means, 1908–9, Vol. II, p. 1987.

In cargo lots the ocean rates were lower, amounting to $3 to $4.50 per ton of 2,240 pounds.

The ocean freights from the European ports named above to New York, Boston, Philadelphia, and Baltimore were 6 to 7 shillings per ton of 2,240 pounds, or nearly $1.50 to $1.75 in American money. The freight by rail from Pittsburgh to the same Atlantic ports varied from $3.25 per gross ton to Baltimore to $4.03 per gross ton to Boston.[1]

War conditions have materially changed this situation for the present. A partial return to prewar conditions may enable the foreign producer to market his goods in certain parts of the country where the American manufacturer is handicapped by higher transportation costs.

Export prices and bounties.—The policy of selling export goods at lower prices than the domestic product obtains in some countries with reference to structural shapes. The Dusseldorf correspondent of the London Iron and Coal Trades Review, in March, 1908, gives the home price for joists as 122s. 6d. to 125s. per ton, while the export price was 109s., the approximate difference in American money being $3.84 per ton.[2] The British consul general of Frankfort (Oppenheimer's report for 1907) also shows a difference between the home and export price in the case of structural material of 20 marks per ton, or $4.76.[3]

The policy of offering virtual bounties to exporters has also been followed by iron and steel associations in Germany. Shortly before the outbreak of war the Stahlwerks Verband sold joists in the export markets with a specified and published rebate of from 3s. to 10s. a ton according to locality.[4]

[1] Tariff hearings before Committee on Ways and Means, 60th Cong., p. 1987 (1908–9).
[2] Ibid., pp. 1996 and 1997. Quoted from the Iron and Coal Trades Review for Mar. 20, 1908.
[3] Tariff hearings, 60th Cong., Vol. II, pp. 1996 and 1997 (1908–9).
[4] The Iron and Coal Trades Review (London), June 14, 1918, p. 667.

TARIFF CONSIDERATIONS.

The imports of structural shapes in the ten years, 1910–1919, have averaged considerably less than 1 per cent of the domestic production, while the exports have ranged from 5 to 15 per cent of the country's output. American producers have thus almost entire control of the home market, and are able to export a moderate proportion of the total production.

For several years, as has been pointed out, over half of the imported material came through the customs districts of the Pacific coast, the cost of transporting structural shapes from Europe to the Pacific coast being less than the cost of shipping the domestic product from Pittsburgh by rail across the continent. The war in Europe has greatly reduced the importation of structural shapes, and the proportion coming through the customs districts of the Pacific coast is also very much less than formerly.

Structural shapes include a great variety of forms and sizes. The twofold division into heavy and light may call for differences in tariff rates. Light structural shapes are higher in price per ton and are thus less influenced in their movement by transportation costs than are the heavy shapes. The uses to which the two classes are put also vary in fundamental respects, and hence in a measure determine their industrial position with reference to any tariff policy. In the class of heavy structural shapes material necessary "for the construction of naval vessels or other vessels of the United States, vessels built in the United States for foreign account and ownership, or for the purpose of being employed in the foreign and domestic trade," has been admitted free under recent tariffs in order to encourage shipbuilding and the development of a national mercantile marine.

Structural shapes—Production in United States.

[From Federal census.]

States.	1899		1904		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
California	6,346	$170,641			20,037	$663,85
Illinois	565	27,000			(1)	(1)
New Jersey	45,300	2,263,000			(1)	(1)
New York	2,545	120,264			(1)	(1)
Ohio	34,195	1,143,872			(1)	(1)
Pennsylvania	766,995	25,578,658			1,597,946	49,512,36
All other	1,037	58,087			505,647	15,388,37
Total	856,983	29,361,522	954,537	$32,730,901	2,123,630	65,564,59

States.	1914		States.	1914	
	Quantity.	Value.		Quantity.	Value.
	Gross tons.			*Gross tons.*	
California	11,974	$658,912	Pennsylvania	1,499,077	$41,178,41
Illinois	222,058	6,009,613	All other	92,638	2,595,01
Indiana	210,343	5,591,345			
Ohio	47,350	1,442,088	Total	2,083,440	57,475,38

[1] Included in "All other."

Structural shapes—Production in United States, 1914.

[From Federal Census of Manufactures, 1914.]

States.	Heavy.		Light.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
[illegible]ornia	5,000		6,974		11,974	$658,912
[illegible]nois	215,583		6,475		222,058	6,009,613
[illegible]iana	184,593		25,750		210,343	5,591,345
[illegible]io	6,288		41,062		47,350	1,442,068
[illegible]nsylvania	1,391,577		107,500		1,499,077	41,178,413
[illegible] other	86,633		6,005		92,638	2,595,015
Total	1,889,674		193,766		2,083,440	57,475,366

NOTE.—Heavy structural shapes are shapes with leg or web 3 inches or over. Light structural shapes are shapes with leg or web less than 3 inches.

Structural shapes—Production in United States—States.

[From Annual Statistical Report of the American Iron and Steel Institute, 1913, p. 65.]

States.	1909	1910	1911	1912	1913	1914 [1]
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
[illegible] York and New Jersey	177,483	1,853,407	1,565,457	122,773	141,690	.....
[illegible]nsylvania	1,642,074			2,050,844	2,133,605	.....
[illegible]abama and Ohio	60,213	40,433	30,773	73,141	87,538	.....
[illegible]diana, Illinois, Michigan, Wisconsin, Colorado, and [illegible]alifornia	395,792	373,050	316,137	599,729	642,139	.....
Total	2,275,562	2,266,890	1,912,367	2,846,487	3,004,972	2,031,124

States not given separately for 1914, 1915, and 1916 in the reports of the American Iron and Steel Institute. Pennsylvania, however, is reported to have produced during these years the following percentages: [illegible]4, 73.5 per cent of the country's total; 1915, 75.3 per cent; and 1916, 72.49 per cent.

Structural shapes (heavy)—Production in United States—States, 1912 and 1913.

[From Report of the American Iron and Steel Institute for 1912 and for 1913.]

States.	1912	1913
	Gross tons.	*Gross tons.*
[illegible] York, New Jersey, and Pennsylvania	1,986,967	2,028,320
[illegible]abama and Ohio	6,818	15,092
[illegible]diana, Illinois, Wisconsin, Colorado, and California	494,630	510,394
Total	2,470,415	2,553,806

NOTE.—In the 1913 and 1914 numbers of the Annual Statistical Report of the American Iron and Steel [illegible]stitute the tonnages for the States mentioned are divided into light and heavy material. For basis of [illegible]ere[illegible]e, see page 4 of this catalogue.

Structural shapes (light)—Production in United States—States, 1912 and 1913.

States.	1912	1913
	Gross tons.	*Gross tons.*
[illegible] York, New Jersey, and Pennsylvania	204,650	246,975
[illegible]bama and Ohio	66,323	72,446
[illegible]ana, Illinois, Wisconsin, Colorado, and California	105,099	131,745
Total	376,072	451,166

[illegible]TE.—In the 1913 and 1914 numbers of the Annual Statistical Report of the American Iron and Steel [illegible]tute the tonnage for the States mentioned for the years 1912 and 1913 are divided into light and heavy [illegible]rial.

Structural shapes (heavy and light)—Production in United States, 1914–1919.

[From Annual Statistical Report of the American Iron and Steel Institute, 1916, p. 41.]

Years.	Heavy.	Light.	Tot
	Gross tons.	*Gross tons.*	*Gross*
1914	1,787,281	243,843	2,03
1915	2,031,407	405,596	2,43
1916	2,649,961	380,003	3,02
1917	2,575,810	534,190	3,11
1918	2,438,126	411,843	2,84
1919	2,136,424	477,612	2,61

NOTE.—For the years 1914, 1915, and 1916 the State production is not divided into heavy and ligh the reports of the Institute, but the country's production during these years is.

Structural shapes—Production in principal foreign countries.

Years.	Canada.[1]	German Customs Union.[2]	Mexic
	Gross tons.	*Metric tons.*	*Gross t*
1910	80,993		1
1911	76,617		
1912	64,082		
1913	68,048	1,555,511	
1914	59,050	1,192,246	
1915	114,829	766,653	
1916	174,490		
1917	189,687		
1918	141,978		
1919	163,489		

[1] Figures for Canada include wire rods. Figures taken from report of American Iron & Steel Associ for 1910, p. 105; from Annual Statistical Report of American Iron & Steel Institute for 1915, p. 94, an same for 1916, p. 94.

[2] Figures are for girders and taken from Commerce Reports, June 22, 1916, p. 1117. They were publi in the Berlin Borsen-Zeitung from reports furnished by the Union of German Iron & Steel manufactu

[3] Annual Statistical Report of the American Iron & Steel Association for 1911, Pt. II, p. 51. Produc is for the Monterey Iron & Steel Co., of Monterey, Mexico.

Structural iron and steel—Imports by countries (fiscal years.)

Imported from—	1910		1912[1]	
	Quantity.	Value.	Quantity.	Valu
	Pounds.		*Pounds.*	
Belgium	9,456,419	$104,617	832,830	$1
France	155,412	4,837	404,925	1
Germany	12,508,665	180,187	4,677,578	9
United Kingdom:				
England	1,406,459	16,810	270,417	
Scotland	159,089	2,132	213,724	
Canada	191,057	6,919	14,480	
Total	23,877,101	315,502	6,413,954	12

Imported from—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Valu
	Pounds.		*Pounds.*		*Pounds.*	
Belgium	1,421,086	$21,238	3,242,750	$41,277	4,550,761	$48,
France	1,194,274	27,581	1,248,758	29,133	244,716	6,
Germany	14,279,587	205,620	18,511,158	253,548	5,624,307	67,
Italy					520	
Netherlands					1,026,508	26,
Sweden			154	5		
United Kingdom:						
England	654,509	15,632	1,594,454	52,945	829,235	67,
Scotland	332,226	5,735	57,657	606		
Canada	50,625	1,568	55,189	906	123,112	8,
Total	17,931,947	277,374	24,710,120	378,420	12,408,159	224,

Structural iron and steel—Imports by countries (fiscal years)—Continued.

Imported from—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Denmark	35,000	$524				
France	120,357	4,286				
Germany	782,002	24,148			46,158	$459
Sweden	60,262	3,619	555,893	$28,423		
United Kingdom:						
England	1,040,125	106,193	395,984	71,926	148,055	42,987
Scotland	180,859	3,910				
Canada	1,323,872	33,148	1,096,521	44,520	11,525,963	647,840
Mexico			238,542	7,012	4,589,126	158,189
Total	3,542,477	175,828	2,286,940	151,881	16,309,322	849,475

[1] Figures for 1911 are not separately stated in Commerce and Navigation, but included under "All other."

Structural iron and steel—Imports by countries (calendar years).

Imported from—	1918		1919		1920	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Germany	46,158	$459	60,798	$2,498	493,089	$26,933
England	33,348	11,139	168,100	27,091	377,222	50,958
Canada	4,420,305	268,059	2,356,619	104,425	2,705,668	197,288
Mexico	3,349,293	121,986			47,590	1,095
All other					149,982	8,019
Total	7,849,104	401,643	2,585,517	134,014	3,773,551	284,293

Iron and steel, manufactures of—Beams, girders, joists, angles, channels, car truck channels, TT columns, and posts, or parts or sections of columns, and posts, deck and bulb beams, sashes and frames, and building forms, and all other structural shapes, of iron or steel, fitted for use—Imports for consumption—Revenue.

Fiscal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1/10 cent per pound	34,359,271	$467,466	$171,796	$0.014	36.75
1908	do	3,605,630	83,252	18,028	.023	21.65
1909	do	11,945,034	182,200	59,725	.015	32.78
1910 [1]	do	2,115,081	33,341	10,575	.016	31.72

[1] July 1 to Aug. 5, 1909, under act of 1897.

*Iron and steel, manufactures of—Beams, girders, joists, * * * and all other structural shapes of iron or steel; not assembled, manufactured, or advanced beyond hammering, rolling, or casting; valued at 1/10 cent per pound or less—Imports for consumption—Revenue.*

Fiscal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	1/10 cent per pound	171,924	$1,575	$515	$0.009	32.75
1911	do	302,174	2,715	906	.009	33.39
1912	do	350	3	1	.009	35.00

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

*Iron and steel, manufactures of—Beams, girders, joists, * * * and all other structural shapes of iron or steel; not assembled, manufactured, or advanced beyond hammering, rolling or casting; valued above $\frac{8}{10}$ cent per pound—Imports for consumption—Revenue.*

Fiscal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	$\frac{8}{10}$ cent per pound	22,130,600	$288,447	$88,522	$0.013	30.69
1911	do	21,605,085	322,303	98,420	.013	30.54
1912	do	9,288,773	160,306	37,155	.017	23.18
1913	do	14,436,658	234,556	57,746	.016	24.62
1913	Free, D.R. Pan. act	651,632	9,666		.015	
1914 [2]	$\frac{8}{10}$ cent per pound	7,005,372	100,882	28,021	.014	27.78
1914 [2,3]	Free, Sec. IV, J5	78,708	1,094		.014	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.
[3] For construction and equipment of vessels.

*Iron and steel, manufactures of—Beams, girders, joists, * * * and all other structural shapes of iron or steel, assembled, manufactured, or advanced—Imports for consumption—Revenue.*

Fiscal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1912	45 per cent	25,079	$195	$87	$0.008	45.00
1913	do	5,405	934	420	.173	45.00

*Iron and steel, manufactures of—Beams, girders, joists, * * * and all other structural shapes of iron or steel, plain, punched, or fitted for use or assembled or manufactured—Imports for consumption—Revenue.*

FISCAL YEARS.

	Rates of duty.	Quantities.	Values.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	10 per cent	19,322,605	$314,690	$31,469	$0.016	10.00
1914 [1]	Free, sec. IV, J5	243,112	2,682		.011	
1915	10 per cent	11,244,688	214,295	21,429	.019	10.00
1916	do	3,458,538	176,022	17,602	.050	10.00
1917	do	1,729,413	123,458	12,345	.071	10.00
1917	Free, sec. IV, J5	110,668	7,981		.072	
1918	10 per cent	16,291,334	847,368	84,736	.052	10.00
1918	Free, sec. IV, J5	35,760	4,649		.130	

CALENDAR YEARS.

1918	10 per cent	7,766,735	$394,902	$39,490	$0.058	10.00
1918 [2]	Free, sec. IV, K	78,925	3,986		.051	
1918 [3]	Free, sec. IV, J5	45,973,264	2,427,739		.053	
1919	10 per cent	2,695,638	131,669	13,167	.049	10.00
1919 [3]	Free, sec. IV, J5	32,220,604	1,881,019		.058	
1920	10 per cent	3,771,611	284,167	28,417	.075	10.00
1920 [3]	Free, sec. IV, J5	8,253	392		.047	
1920 [4]	Free, sec. IV, J6	1,940	126		.065	
1920 [5]	Free, C. R. art. 392	120,000	23,000		.192	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] For supplies of vessels.
[3] For construction and equipment of vessels.
[4] For the repair of vessels.
[5] For the U. S.

Structural iron and steel—Domestic exports (fiscal years).

Imported from—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
Canada	66,584	$2,828,338	79,644	$3,496,033	129,216	$5,150,353
Panama	9,035	529,090	10,871	562,952	47,053	2,416,388
Mexico	14,126	817,291	26,847	1,653,228	5,289	356,716
Cuba	7,839	483,125	15,657	814,697	13,464	548,566
Argentina	3,309	145,277	1,048	56,202	6,283	326,394
Brazil	4,561	280,294	4,215	251,585	3,958	246,763
Chosen (Korea)			1,386	69,344	7,441	352,120
Japan	2,903	158,968	9,532	476,727	17,702	807,906
Australia and Tasmania	4,236	144,908	7,640	287,913	5,346	184,287
All other	7,555	403,260	19,245	1,015,170	15,783	690,870
Total	120,228	5,800,551	176,085	9,683,851	251,535	11,082,133

Exported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
Spain	6,435	$296,496	2,098	$96,264	11	$1,936
United Kingdom	14	450	19	1,010	7,389	260,513
Canada	240,402	9,242,288	200,595	6,990,022	84,416	2,535,404
Panama	31,431	2,543,036	17,343	1,355,287	19,443	920,932
Mexico	8,312	441,757	5,022	296,824	1,232	67,707
Cuba	15,129	723,794	12,397	531,854	17,893	740,119
Argentina	1,794	94,779	10,715	664,084	5,534	280,005
Brazil	9,610	467,922	2,780	163,641	2,146	97,446
Chile	5,859	232,181	8,759	450,213	4,882	243,493
Japan	16,343	646,622	6,035	368,884	1,553	97,256
Australia	12,025	441,049	6,996	265,755	7,735	258,544
Philippine Islands	3,041	102,675	5,799	341,644	1,233	71,614
All other	16,259	821,739	17,743	1,006,591	15,197	714,497
Total	366,654	16,054,788	296,282	12,533,063	168,664	6,289,466

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
France	17,537	$780,274	48,995	$3,531,764	11,542	$1,002,907
Russia in Europe	5,192	236,452	586	37,622	680	72,290
United Kingdom	15,661	593,187	9,540	547,157	3,852	298,838
Canada	110,677	4,284,757	124,014	8,022,251	111,994	9,198,698
Panama	13,727	751,525	3,605	305,918	1,892	153,295
Trinidad and Tobago	5,538	176,001	122	12,966	202	29,581
Cuba	26,978	1,429,423	39,770	2,736,521	17,763	1,828,588
Argentina	8,187	410,558	7,565	563,805	9,914	1,026,456
Chile	2,380	112,192	10,578	788,065	4,551	523,186
China	3,090	215,747	5,619	360,656	3,659	493,632
British India	6,712	296,982	2,010	111,457	1,149	124,999
Japan	8,851	427,785	31,350	1,996,482	42,562	5,801,081
Australia	14,053	647,008	11,630	530,943	2,098	152,774
All other	31,728	1,643,280	44,102	3,365,755	28,526	3,118,564
Total	270,311	12,005,171	339,486	22,911,356	240,394	23,824,889

NOTE.—Figures for countries and totals are taken from Commerce and Navigation.

Structural iron and steel—Domestic exports (calendar years).

Exported to—	1918		1919		1920	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Valu
	Gross tons.		*Gross tons.*		*Gross tons.*	
France	26,795	$2,282,957	79,665	$6,366,834	13,872	$1,34
United Kingdom	5,038	384,708	1,399	94,616	10,187	80
Canada	111,118	8,211,009	99,032	6,209,025	137,930	8,98
Panama	1,107	77,328	532	44,385	1,344	11
Trinidad and Tobago	195	27,911	41	5,017	275	3
Cuba	11,112	1,098,109	23,600	1,953,297	47,703	4,70
Argentina	3,645	391,665	13,265	1,107,146	32,320	2,53
Chile	5,156	659,756	9,917	1,377,593	2,489	23
China	4,561	562,287	6,033	576,890	6,037	64
British India	865	97,947	5,365	447,470	39,840	2,54
Japan	24,197	3,398,470	49,920	4,360,251	89,839	6,29
Australia	1,537	128,122	3,216	193,764	4,020	26
All other	37,403	4,148,183	68,802	6,220,528	107,799	9,93
Total	232,729	21,468,452	360,797	28,956,816	493,655	38,39

Structural shapes (I beams)—Prices, wholesale, per pound, Pittsburgh, Pa.

[From Iron Age, Jan. 3, 1918, p. 69.]

	1910	1911	1912	1913	1914	1915	1916	1917	1918	19
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	Ce
January	1.550	1.40	1.15	1.75	1.20	1.10	1.90	3.25	3.00	
February	1.510	1.40	1.11	1.71	1.20	1.10	2.06	3.25	3.00	
March	1.500	1.40	1.15	1.70	1.19	1.10	2.40	3.54	3.00	
April	1.500	1.40	1.21	1.68	1.15	1.20	2.55	3.88	3.00	
May	1.500	1.39	1.25	1.50	1.14	1.20	2.60	4.00	3.00	
June	1.480	1.35	1.25	1.45	1.11	1.20	2.53	4.31	3.00	
July	1.410	1.35	1.30	1.45	1.12	1.25	2.50	4.50	3.00	
August	1.400	1.35	1.35	1.45	1.19	1.30	2.52	4.30	3.00	
September	1.400	1.34	1.42	1.41	1.20	1.35	2.64	4.00	3.00	
October	1.400	1.21	1.48	1.37	1.15	1.44	2.75	3.00	3.00	
November	1.400	1.13	1.57	1.29	1.10	1.60	2.86	3.00	3.00	
December	1.400	1.15	1.60	1.25	1.07	1.78	3.25	3.00	2.90	
Annual average	1.455	1.32	1.32	1.50	1.15	1.30	2.55	3.67	2.99	
Highest monthly average	1.550	1.40	1.60	1.75	1.20	1.78	3.25	4.50	3.00	
Lowest monthly average	1.400	1.13	1.11	1.25	1.07	1.10	1.90	[1] 3.00	2.90	

[1] Government price $3.00

Structural shapes (channels, 6-inch up to and including 12-inch web)—Prices, wholes per gross ton, Midlands, England.

[From Iron and Coal Trades Review (London).]

[Price reduced to dollars and cents from pounds, shillings, and pence.]

	1913	1914	1915	1916
January	$40.46	$31.94	$38.02	$5
February	40.46	31.94	40.46	5
March	40.46	31.94	42.28	5
April	40.46	31.94	45.32	(1)
May	40.46	31.94	45.32	(1)
June	40.46	31.63	47.76	(1)
July	40.46	31.33	47.76	(1)
August	38.99	36.20	47.76	(1)
September	38.02	36.81	47.76	[2] 5
October	35.10	36.81	47.76	(1)
November	33.16	36.81	47.76	(1)
December	32.24	38.02	50.67	(1)
Average	38.39	33.94	45.72	.....
	Cents per pound.[3]	*Cents per pound.*[3]	*Cents per pound.*[3]	*Cents p pound*
Annual average	1.7	1.5	2.0	.....
Highest monthly average	1.8	1.7	2.3	
Lowest monthly average	1.4	1.4	1.7	

[1] No separate quotations.
[2] Controlled price in England. Price apparently fixed through 1917 and 1918.
[3] Reduced to cents per pound in order to make prices comparable with quotations for American I bea

Court and Treasury Decisions.

The act of 1883 provided for structural shapes of iron or steel without words of limitation or extension. In 1890 the words "whether plain or punched, or fitted for use," were added. These words were carried, without addition, into the acts of 1894 and 1897. In 1909 they were changed to the phrase "not assembled, or manufactured, or advanced beyond hammering, rolling, or casting." The act of 1913 reads, "whether plain, punched, or fitted for use, or whether assembled or manufactured." Sashes and frames were not provided for eo nomine before 1913. In view of these changes in the law, the decisions will be given under the respective acts.

Act of 1883.—Pieces of iron specially manufactured, fitted, and shaped as parts of a particular floor frame were held dutiable under the act of 1883 as manufactures of metal and not as iron or steel beams, girders, joists, or building forms, although they might be merchantable as beams or other articles specially enumerated when the frame was taken to pieces. (Birtwell *v.* Saltonstall, 39 Fed., 383; 150 U. S., 417; 63 Fed., 1004; 66 Fed., 969.)

Act of 1890.—Wrought-iron bars from 5½ to 13½ feet in length, with an average weight of about 22 pounds, rolled into shape for use in the Helliwell system of building glass roofs and skylights, were held dutiable as structural shapes of iron and not as bars or shapes of rolled iron, n. s. p. f. (par. 136). (In re Plenty, G. A. 1484, T. D. 12933 (1892).)

Bulb bars, 7 inches wide by three-eighths inch thick by 21 feet 8 inches long, used principally for deck beams in shipbuilding, were also held to be structural shapes. The importer claimed under paragraph 146, presumably under the provision for steel in all forms and shapes. (In re Hempstead, G. A. 1936, T. D. 13698 (1893).)

But ball-and-socket joints for water pipe, the joint including a cast-iron zone turning in a socket formed of angle, channel, bar, and boiler iron, were held not dutiable as structural shapes but as cast-iron pipe (par. 160). Paragraph 137 was limited to such angles, channels, etc., as were structural shapes. (In re Colpoys, G. A. 2551, T. D. 14922 (1894).)

Act of 1897.—Ornamental iron work, T-shaped and otherwise, 2 to 3 inches in width, was held dutiable under paragraph 125 as structural iron and not under paragraph 124 as roller bar iron. (In re Braun, G. A. 4119, T. D. 19198 (1898).)

Pieces of flat steel 1 inch in thickness, varying in width from 12 to 24 inches, and in length from 14½ to 19⅞ feet, were held dutiable under paragraph 135 as forms or shapes not structural. To fall within paragraph 125, steel, even though intended for use in building construction, must have form or shape, making it readily recognizable as a form or shape of structural steel. (In re McNear, G. A. 5395, T. D. 24602 (1903).)

Steel plates, 12 feet by 59 inches by five-sixteenths inch, checkered on one side to prevent slipping and intended to form the flooring of a boiler room, were held dutiable under paragraph 135 as steel plates, n. s. p. f., and not as structural shapes, nor under paragraph 126 as boiler or other plate of iron or steel, which provision was declared to apply to plate steel and not to steel plates. (United States *v.* Wood, T. D. 28655 (1907), affirming G. A. 5886, T. D. 25915.)

Complete steel window sashes with steel sides fitted with gun-metal stays and gun-metal handles or hinges, all fastened together, were held to have been advanced and manufactured into products no longer "building forms" or "structural shapes," and dutiable as manufactures of metal. (Ackerson *v.* United States, 178 Fed., 1003 (T. D. 30469), affirming 172 Fed., 303 (T. D. 29823), which affirmed G. A. 6810, T. D. 29276 (1908–1910).)

Act of 1909.—Universal mill plates invoiced as "flats" and varying from 7 to 14 inches in width, one-fourth to three-fourths inch in thickness, and from 20 to 22 feet in length, in ordinary rectangular form, were held to be dutiable either as plate steel or as steel plates under paragraph 122 or 131, and not as structural shapes. (In re Bush, G. A. 7410, T. D. 33017 (1912).)

The structural-shapes provision, compared with the provision in paragraph 131 for "pressed, sheared, or stamped shapes," was construed by the Court of Customs Appeals to enumerate articles subjected to the more common process of hammering, rolling or casting, and to be intended to cover a class of merchandise of a cruder form and ordinarily advanced to a less degree of manufacture or completeness than paragraph 131. In accordance with this construction, pressed frames of automobiles were held to be dutiable under paragraph 131 rather than paragraph 121, and pile projections made of sectional semicircular iron plates, punched after rolling, were held dutiable under paragraph 199 of that act as manufactures of iron and not as structural shapes, because advanced beyond hammering, rolling, or casting, and changed into a form ready for riveting together into a drum. (Kuyper *v.* United States, 5 Ct. Cust. Appls., 175 (1914), affirming Abstract 33645, T. D. 33763; United States *v.* American Railroad Co., of Porto Rico, 5 Ct. Cust. Appls., 474 (1914), reversing Abstract 35945, T. D. 34571.)

Act of 1913.—Under the act of 1913, which contained a provision for sashes and frames, window sashes and frames of steel, having attached thereto gun-metal hinges and stay pins and brass bushings, 90 per cent steel and 10 per cent brass and gun metal, were held dutiable as sashes and frames under paragraph 104 and not as manufactures of metal under paragraph 167. These articles were completely fitted window sashes and frames in chief value of steel, the gun-metal hinges and stay pins and brass bushings being absolutely essential parts, without which the sashes would be utterly incapable of use. (In re Gavin, G. A. 7591, T. D. 34675 (1914), followed in Abstract 36847, T. D. 34908 (1914); Abstract 37467 (1915); Abstracts 37543 and 38121 (1915).)

Turntables, trusses, girders, girder box beams, and other structural shapes constituting parts of railroad bridges which had been dismantled, were held exempt from duty under paragraph 518 as secondhand or waste or refuse iron or steel, fit only to be manufactured, and not dutiable under paragraph 104 as structural shapes. (In re Oakleaf, G. A. 8118, T. D. 37464 (1917); also Abstract 41340.)

Paragraph 104 was held not to include structural shapes of steel containing an alloy. Paragraph 110, imposing 15 per cent ad valorem on "all steels by whatever process made, containing alloys such as nickel, cobalt," etc., was held to be the proper classification. (Kuyper *v.* United States, 7 Ct. Cust. Appls., 212, affirming Abstract 39190 (1916).)

Structural iron and steel—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	178	Iron or steel beams, girders, joists, angles, channels, * * * TT, columns and posts, or parts or sections of columns and posts, deck and bulb beams, and building forms, together with all other structural shapes of iron or steel	1¼ cents per pound.
1890	137	Beams, girders, joists, angles, channels, car-truck channels, TT, columns and posts or parts or sections of columns and posts, deck and bulb beams, and building forms, together with all other structural shapes of iron or steel, whether plain or punched, or fitted for use	$\frac{1}{10}$ cent per pound.
1894	113	Beams, girders, joists, angles, channels, car-truck channels, TT, columns and posts or parts or sections of columns and posts, deck and bulb beams, and building forms, together with all other structural shapes of iron or steel, whether plain or punched, or fitted for use	$\frac{1}{8}$ cent per pound.
1897	125	Beams, girders, joists, angles, channels, car-truck channels, TT, columns and posts or parts or sections of columns and posts, deck and bulb beams, and building forms, together with all other structural shapes of iron or steel, whether plain or punched, or fitted or use	$\frac{1}{8}$ cent per pound.
1909	121	Beams, girders, joists, angles, channels, car-truck channels, TT, columns and posts or parts or sections of columns and posts, deck and bulb beams, and building forms, together with all other structural shapes of iron or steel, not assembled or manufactured, or advanced beyond hammering, rolling, or casting, valued at nine-tenths of 1 cent per pound or less	$\frac{1}{8}$ cent per pound.
		Valued above nine-tenths of 1 cent per pound	$\frac{1}{8}$ cent per pound.
1913	104	Beams, girders, joists, angles, channels, car-truck channels, TT, columns and posts or parts or sections of columns and posts, deck and bulb beams, sashes, frames, and building forms, together with all other structural shapes of iron or steel, whether plain, punched, or fitted for use, or whether assembled or manufactured	10 per cent ad valorem.

UNITED STATES TARIFF COMMISSION

WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 105 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

Iron and Steel Plates
Iron and Steel Sheets
Iron and Steel Sheets advanced beyond stage of hot rolling
Tin and Terne Plate
Galvanized Sheets
Strip Steel
Hoop, Band, and Scroll Iron and Steel
Cotton Ties
Saws

Paragraph 105:
Iron and Steel Plates (including Boiler Plate, Crucible Plate Steel, Saw Plate, and Skelp); **Iron and Steel Sheets** (general survey); **Iron and Steel Sheets advanced beyond hot rolling**; and **Strip Steel**

Paragraph 107:
Hoop, Band or Scroll Iron or Steel

Paragraph 109:
Iron and Steel Plates; **Iron and Steel Sheets**; **Iron and Steel Sheets advanced beyond hot rolling**; **Tin and Terne Plate**: **Galvanized Sheets**; **Strip Steel**; **Hoop, Band, and Scroll Iron and Steel**; **Cotton Tires**; **Saws**

Paragraph 110:
Iron and Steel Plates; **Iron and Steel Sheets**; **Iron and Steel Sheets advanced beyond hot rolled**; **Strip Steel**

Paragraph 139:
Saws

Paragraph 509:
Cotton Ties

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and index" the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of Abraham Berglund, H. J. Bierman, and L. A. Rufener, of the Metals Division of the Commission's staff, and of others.

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IRON AND STEEL PLATES.

SUMMARY.

The manufacture of plates and sheets is one of the most important branches of the iron and steel industry. In 1919 there were produced in the United States 25,101,544 gross tons of rolled material. Of this rolled product plates and sheets constituted 7,372,814 gross tons, or over one-fourth of the total. The production of plates alone amounted to nearly 4,000,000 gross tons.

The term "plates" is applied to flat pieces of iron and steel over 6 inches in width and of the thickness of No. 12 wire gauge (seven sixty-fourths inch) or over. When such material is thinner than No. 12 wire gauge, it belongs to the category of sheets. What are called tin plates and black plates are sheets and not plates.

Plates are used in the building of hulls of vessels, parts of bridges and buildings, tanks, safes, boilers, circular saws, and the like, where strength and rigidity are required. Specifications call for different kinds of steel and iron in the manufacture of plates for these various uses.

The price of iron and steel plate in the United States is usually quoted by the pound, with Pittsburgh, Pa., as a base. During the two years immediately preceding the outbreak of war in Europe the Pittsburgh price of tank plate ranged from 1.10 to 1.75 cents per pound. In 1917 the price at one time was as high as 9 cents. In April, 1920, tank plate was quoted at 3.75 cents per pound. This price, while high compared with prewar quotations, is considerably lower than that of the corresponding English material. British prices have tended to increase faster than those of the United States.

The imports of both plates and sheets during the past eight years have been less than 1 per cent of the country's production of steel plates alone. On the other hand, the exports of steel plate alone in 1919 were over 10 per cent of the domestic output. Over half of the imports came from England and a considerable percentage of the remainder from Sweden.

With the exception of a limited amount of plate produced in countries having special advantages with respect to the supply of certain kinds of pig iron and abundant and cheap water power, both of which can be utilized in the manufacture of steel for special kinds of plate, the American manufacturer has several advantages over his foreign competitors. Crude steel and coal are cheaper here than abroad. The use of elaborate machinery keeps the labor cost per unit of output relatively low. From the standpoint of competitive conditions there is no tariff problem involved in the manufacture of ordinary tank and ship plate. In the making of certain special plates, where crucible or electric furnace steel is used, whatever advantages the foreign producer may have are due to the kind of steel used rather than to the process of converting the crude steel into plate.

The question of classification is important from an administrative standpoint, and our tariff laws are very confusing in the grouping of different kinds of plates and of plates and sheets. Skelp is classed

with boiler plate, from which it differs fundamentally in both use and value, but separated from ordinary plates and sheets with which it is more closely related. The distinction, too, between plates and sheets is not clearly drawn. While in certain cases plates and sheets have the same or similar uses, the two are generally separated from each other in practice by certain broad differences in use and character. As these differences are fundamental the distinction should be observed in tariff legislation.

Iron and steel plates—Summary table.

Year.	Domestic production.	Imports for consumption.[1]	Domestic exports.[2]	Ratio to production.		Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
				Imports.	Exports.				
	Gross tons.	*Gross tons.*	*Gross tons.*	*Per cent.*	*Per cent.*				*Per cent.*
1910.....	2,807,728	5,269	235,051	0.187	8.37	$184,829.00	$112,068.81	$92.02	23.11
1911.....	2,334,341	2,042	304,401	.087	13.04	262,008.00	58,291.75	128.31	22.25
1912.....	3,035,200	1,529	465,317	.05	15.33	225,806.00	47,904.49	147.68	21.21
1913.....	3,092,770	3,216	295,339	.107	9.84	391,979.00	82,217.29	121.88	20.97
1914.....	2,112,421	2,425	171,806	.114	8.14	325,957.00	45,783.65	134.42	14.05
1915.....	2,878,051	1,592	133,440	.055	4.64	200,867.00	21,673.12	126.17	10.79
1916.....	3,677,384	1,482	313,910	.04	8.54	264,200.00	27,984.42	178.27	10.59
1917.....	4,158,238	1,639	474,009	.039	11.40	438,306.00	50,613.44	267.42	11.55
1918.....	5,119,908	1,945	535,204	.037	10.45	665,170.00	71,736.31	341.99	10.78
1919.....	3,891,321	1,096	787,758	.028	20.24	312,963.00	39,205.05	285.55	12.53
1918[3].....	5,119,908	1,394	592,723	.027	11.58	366,905.00	31,715.93	263.20	8.64
1919[3].....	3,891,321	864	749,905	.022	19.27	301,370.00	32,164.90	348.81	10.67

[1] Figures include a large percentage of sheets—iron and steel plates not being separately stated.
[2] Includes some iron sheets. The greater part of these exports consist of steel plate.
[3] Calendar years.

General Information.

TARIFF ACT OF 1913.

PAR. 105. Boiler or other plate iron or steel, and strips of iron or steel, not specially provided for in this section; * * * including crucible plate steel and saw plates, cut or sheared to shape, or otherwise, or unsheared, and skelp iron or steel, whether sheared or rolled in grooves, or otherwise, 12 per cent ad valorem.

PAR. 110. Steel bars, * * * sheets, and plates, all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, 8 per cent ad valorem.

* * * All descriptions and shapes of dry sand, loam, or iron molded castings, sheets, and plates: * * * all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, 15 per cent ad valorem.

DESCRIPTION.

Plates and sheets constitute one of the five or six leading groups into which finished iron and steel products are divided. Bars, shapes, wire, and rails have great length compared with their other dimensions, but plates and sheets have their width also well developed.

Plates are flat pieces of metal ranging in thickness from seven sixty-fourths inch (No. 12 wire gauge) [1] to 2 inches and in width from 6 to 194 inches. They are cut to various lengths. Pieces of metal

[1] No. 10 wire gauge (nine sixty-fourths inch thick) is sometimes used as the dividing line between plates and sheets, and this standard is used in the tariffs of 1890 to 1909, inclusive.

thinner than No. 12 wire gauge are usually called sheets, although the term plate is applied to steel sheets coated with tin or terne (tin plate and terneplate) and to sheets (black plate) which are prepared for a coating of tin or terne. (See Survey on Tin and Terne Plate.) The dividing line between plates and sheets is not always clearly drawn, largely because the uses of certain kinds of plates and sheets are practically identical, and the dividing line is therefore arbitrary and of no value in these instances.

Plates are made of several kinds of metal, but the plates treated in this survey are manufactured out of iron and steel. While some plate is made out of wrought iron, steel greatly preponderates as the material used.

Classes.—Plates are divided into universal and sheared. The former have their edges as well as their surfaces rolled and need only to be sheared at their ends. The latter have their edges as well as their ends sheared. Sheared plates are further subdivided into those rolled on single stands and those roughed and finished on separate stands.[1]

Uses.—Plates are used for armoring battleships, for building safes, locomotive fire boxes, railroad cars, ship hulls, tanks, parts of bridges, boilers, and other purposes for which strength and rigidity are required. Skelp, nail, and saw plates are special kinds of plates used in the manufacture of pipes or tubing, cut nails, and hand and machine saws, respectively.

Armor plate is an especially heavy plate, generally made from alloy steel, made according to Government specifications and for governmental uses and will not be specially treated in this survey. Tank and ship plates are made of ordinary steel and used for building and ship construction. Boiler plate requires comparatively pure steel in order to meet the high standards usually adopted in boiler manufacture. Specifications generally call for steel of low carbon and very low phosphorus content. Boiler plate, therefore, sells at a higher price than ordinary steel plate.[2] Saw plate, which is made of steel of high carbon content, also requires high-grade steel and commands a relatively high price. Skelp, used in the manufacture of pipe and tubing, is rolled to such width and thickness as may be necessary to conform to a given diameter. The edges of skelp are usually sheared. When they are rolled or cut to a wedge shape, the plate is called "scarfed" skelp and is used in the manufacture of lap-welded pipes. When it is rolled in a mill having grooves cut in the rolls the width of the plate, it is known as grooved skelp. Nail plates are used for the manufacture of cut nails. These plates may be of uniform thickness, wedge shaped, or have raised portions on either edge for forming the heads of the nails produced. Skelp and nail plate are made out of ordinary steel and sell at a lower price than tank plate.

DOMESTIC PRODUCTION.

The total production in the United States of all kinds of finished rolled iron and steel in 1919 amounted to 25,101,544 gross tons. Of this output 7,372,814 gross tons, or over 29 per cent, consisted of plates and sheets. The production of plates alone amounted to 3,891,321 gross tons.

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[1] This classification has been used by the American Iron and Steel Institute since 1913.
[2] Wrought iron is also used to some extent in the manufacture of boiler plate.

of rails for the same year and about 80 per cent in excess of the try's output of structural shapes.

mestic production and consumption.—During the years 1913 to inclusive, the country's output of iron and steel plates have ed from 2,112,421 gross tons in 1914 to 5,119,908 gross tons in Production during the same period greatly exceeded con- tion. Imports constituted only a fraction of 1 per cent of the try's consumption, while the annual exports ranged from about 10 per cent of the domestic production.

xports.—Exports during the present century have shown a pro- ced tendency to increase. In 1902 and 1903 the annual exports oth plates and sheets aggregated less than 20,000 gross tons. In the exports of steel plates alone amounted to 710,013 gross tons. efore the outbreak of the war Canada was taking from two- ds to four-fifths of the domestic exports. During the years 1916 1919, inclusive, Japan became a very important market for erican plate, that country taking about 35 per cent of the Ameri- exports. Much of the steel plate shipped to Japan during the rs 1916–1919 was for shipbuilding purposes.

FOREIGN PRODUCTION.

n the prewar period both Great Britain and Germany were large ducers of iron and steel plate. The output of the latter country the years 1914 and 1915 amounted to 1,172,966 and 966,898 ric tons, respectively.[1] Accurate statistics with reference to r years are not at present (1920) available, but all indications t to a material decline during the war period.

he United Kingdom before 1914 exported a considerable tonnage late. In 1912 exports aggregated 282,898 gross tons, and in 1913, ,051 gross tons.[2] The output of plates in Great Britain in 1917 1918, based upon figures in the returns made to the ministry of nitions amounted to 1,326,584 gross tons and 1,345,493 gross tons, pectively.[3] Much of the British plate consists of ship plate used he building of vessel hulls.

he output of finished steel in Canada has been increasing in late rs. In published figures plates are not separated from those of ets, merchant bars, tie plate bars, etc. The combined output of group of products in 1917 was 745,162 gross tons, and in 1918, ,021 gross tons. Mention should also be made of Sweden, which duces a considerable amount of plate out of crucible and electric- nace steel.

IMPORTS.

mports of certain kinds of plates are difficult to state in precise ires, as they are grouped with sheets in Government publications. wever, the total importation of plates and sheets has been insig- cant compared with the domestic production of plates alone—a tion of 1 per cent during the past decade. (1910–1919.)

n the fiscal year of 1913 the importation of sheets and plates made the Bessemer or open-hearth process, and not containing alloys,

neral Industry, 1915. Metric ton=2,204.6 pounds.
st, 1913 and 1916.
ed, 1918, p. 295.

amounted to 5,351,622 pounds (2,389 gross tons); boiler and other plate to 715,253 pounds (319 gross tons), and saw plates to 857,534 pounds (383 gross tons). Besides these plates there was some importation of skelp and other plate. During the war importation declined and in the fiscal year 1919 the imports of Bessemer and open-hearth sheets and plates without alloys, boiler and other similar plate, and saw plate aggregated, respectively, 830,549 pounds (371 gross tons), 27,059 pounds (12 gross tons), and 23,461 pounds (10 gross tons). The importation of sheets and plates made by the crucible, electric, and cementation processes in 1919 amounted to 572,738 pounds (256 gross tons).

Considerably over half of this imported material comes from the United Kingdom. Other important contributing countries are Sweden, Canada, and in the prewar period Germany and Belgium.

PRICES.

The price of plate varies with the kind of steel used, the processes employed in finishing the plate, and the distance of the market from producing centers. Plate made of crucible and electric furnace steel commands a higher price than plate manufactured out of Bessemer and open-hearth steel. The specifications for boiler plate call for purer steel than those for ordinary tank or ship plate. Saw plate requires a fine temper and is correspondingly expensive.

In the United States plates are quoted by the pound, and as in the case of a large number of iron and steel products, with Pittsburgh, Pa., as a base. The general price movement in plates during recent years is indicated by the prices of ordinary tank plate. During the five years 1910 to 1914, inclusive, the highest and lowest monthly averages for this kind of plate were 1.75 cents per pound in January, 1913, and 1.05 cents per pound in December, 1914, respectively. The annual average per pound for 1913 was 1.50 cents and for 1914, 1.14 cents. After 1914 prices increased, and by December, 1916, had reached 4.25 cents. The maximum monthly quotation was 9 cents per pound in July, 1914. After September, 1917, the price was fixed by the War Industries Board at 3.25 cents, and this price prevailed until December, 1918, when it began to decline. In September, 1919, the monthly average was 2.53 cents. Since then prices have increased and declined, the average for April, 1920, being 3.75 cents per pound and for April 1921, 2.00 cents per pound.

Skelp was quoted at lower prices. In 1917 the highest monthly average for grooved steel skelp was 4 cents per pound, and for skelp of sheared steel, 6 cents per pound. The quotations for April, 1920, were 2.75 cents per pound, and 3 cents per pound, respectively, and for April, 1921, at 2.10 and 2.45 cents.

In England prices are quoted by the ton. Ship, bridge, and tank plates were quoted in 1919 at prices ranging from £12 to £21 per gross ton ($58.40 to $102.20),[1] averaging for the year £16 16s. 2d. ($81.82).[1] The corresponding annual average for the same plate in the United States during the same year was $60.93 per gross ton. In April, 1920, British tank and ship plate sold at $114.38 (£23) per

[1] Prices computed at the normal rate of exchange. At the rates of exchange then current prices averaged materially higher in England than in the United States.

gross ton in England and Wales, while the corresponding American plate sold in Pittsburgh at $84 per gross ton. The price of British boiler plate during the same month was $138.71 per gross ton (£28).

TARIFF HISTORY.

Prior to the act of 1913 the duties on iron and steel plates were for the most part specific, and varied according to kind, value, and finishing processes employed. In the act of 1883 boiler plate bore a duty of 1¼ cents per pound. Plates, other than boiler plate and steel circular-saw plates, when valued at 4 cents per pound or less were dutiable at 45 per cent ad valorem; and when valued at more than 4 cents per pound at specific duties ranging from 2 cents to 3¼ cents per pound. Steel circular-saw plates paid 1 cent per pound in addition.

In 1890 the provisions for plates became more elaborate. On boiler and other plate, except saw plate, rates varied from 0.5 cent per pound on plates valued at 1 cent per pound or less to 45 per cent ad valorem in the case of plates valued above 13 cents per pound. Saw plates paid duties varying from 0.4 cent per pound to 7 cents per pound, depending upon value, and circular-saw plates 1 cent per pound in addition to these rates. Where plates were cold-rolled, cold-hammered, tempered, or polished, a rate of 1¼ cents per pound was added to those already imposed on boiler and other plates.

The act of 1894 materially reduced these rates, the duties on boiler and other plate ranging from 0.5 cent per pound when valued at 1 cent per pound or less to 30 per cent ad valorem when valued above 1¼ cents and not above 4 cents per pound, and 25 per cent ad valorem when valued over 4 cents per pound. The rates on saw plates ranged from 0.3 cent per pound to 4.7 cents per pound.

In 1897 the duties on saw plates remained practically the same as under the act of 1894, with an addition of 0.5 cent per pound in the case of circular-saw plate. The rates on ordinary boiler and other plate were changed in some minor particulars, but an addition of 1 cent per pound was made in the case of plates which had gone through certain finishing processes.

The act of 1909 reduced the rates on iron and steel plates. The duties on boiler and other plates, iron and steel, ranged from 0.3 cent per pound to 0.6 cent per pound where specific duties were levied, and 20 per cent ad valorem when plate was valued at over 3 cents per pound. Plates not specially provided for paid duties ranging from seven-fortieths cent per pound to 7 cents per pound, specific duties, and 20 per cent ad valorem in the case of plates valued above 40 cents per pound. An addition of 0.4 cent per pound was made in the case of plates subjected to cold-rolling, cold-hammering, tempering, or polishing.

In 1913 the rates were changed into ad valorem duties and very materially reduced. These rates ranged from 8 to 15 per cent ad valorem. In view of the great increase in prices during the war the reductions are not so great as they would have been had specific rates been imposed on the price basis of 1913.

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already indicated (see under "Imports"), imports are s
ıared with domestic output and exports. Tank and ship pl
.t the present time (1920) in the United States at lower p
in England, whence more than half the imported product co
e conditions of manufacture in the United States are not
ar to those of other rolled iron and steel products. Raw mat
e forms of crude steel and coal are cheaper here than abr
he use of elaborate machinery keeps the labor cost from be
large percentage of the total cost.

e Federal Trade Commission, in the determination of the cos
and steel products during the war for the use of the price-fi
nittee of the War Industries Board and of certain purch
rtments of the Government, obtained the monthly cost shee
ıroducing companies showing the average mill cost of produ
ed plates and universal plates from October, 1917, to Decen
, inclusive. These cost sheets were for mill costs and did
r general and administrative expenses or general depreci
ıe request of the Tariff Commission for information respectin
ortion of the various items of cost to the mill cost, the Fe
e Commission compiled the costs as reported by five repres
companies. They did not, of course, include any items for i
r for income or excess profits taxes. If the additional cost
ral and administrative expenses and for general depreci
l be determined with accuracy, there would be a substantial
to the mill cost as shown below.

ıese data have not as yet been published by the Federal T
mission and were furnished to the Tariff Commission with
ment that they were subject to revision. While these fig
the reported mill costs for only five companies, it is beli
they are sufficiently representative to show the relative im
e of the particular items entering into mill costs. For quar
ıds these costs were as follows:

ge cost of sheared plates of five representative companies, by quarters, October, to December, 1918.

[In dollars per gross ton.]

Items of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	Oct Dec
ıduction (gross tons)	423,834	559,105	773,429	756,336	
tal	$42.30	$42.36	$40.42	$42.79	
	.87	.93	.77	.84	
	3.29	3.07	3.02	3.43	
nance and repairs	1.98	1.82	1.70	1.74	
	.19	.29	.34	.36	
and power	.98	1.13	.93	.90	
ling and contingent	.09	.03	.04	.04	
mill costs	1.32	1.87	1.34	1.66	
fill cost	51.02	51.50	48.56	51.76	

Average cost of sheared plates of five representative companies, by quarters, October, 1917, to December, 1918—Continued.

PER CENT OF MILL COST.

Items of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	October to December.
Net metal	81.94	82.25	83.24	82.67	81.69
Fuel	1.69	1.81	1.59	1.62	1.81
Labor	6.37	5.96	6.22	6.63	6.98
Maintenance and repairs	3.84	3.53	3.50	3.36	3.90
Rolls	.37	.56	.70	.69	.59
Steam and power	1.90	2.20	1.91	1.74	1.79
Rebuilding and contingent	.17	.06	.08	.08	.07
Other mill costs	3.72	3.63	2.76	3.21	3.17
Mill cost	100.00	100.00	100.00	100.00	100.00

Average cost of universal plates of five representative companies, by quarters, October, 1917, to December, 1918.

[In dollars per gross ton.]

Items of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	October to December.
Production (gross tons)	221,978	176,316	212,792	292,811	254,454
Net metal	$33.76	$35.54	$35.99	$37.25	$39.27
Fuel	.92	.95	.87	.81	.91
Labor	2.08	2.30	2.35	2.43	2.92
Maintenance and repairs	1.61	1.33	1.28	1.36	1.63
Rolls	.11	.15	.17	.16	.17
Steam and power	1.12	1.39	.91	1.01	1.19
Rebuilding and contingent	.02	.03	.03	.02	.02
Other mill costs	1.17	1.09	.92	1.07	1.14
Mill cost	40.79	42.83	42.52	44.11	47.25

PER CENT OF MILL COST.

Net metal	82.76	82.98	84.64	84.45	83.11
Fuel	2.25	2.22	2.05	1.84	1.93
Labor	5.10	5.37	5.53	5.51	6.18
Maintenance and repairs	3.95	3.22	3.01	3.08	3.45
Rolls	.27	.35	.40	.36	.36
Steam and power	2.75	3.25	2.14	2.29	2.52
Rebuilding and contingent	.05	.07	.07	.05	.04
Other mill costs	2.87	2.54	2.16	2.42	2.41
Mill cost	100.00	100.00	100.00	100.00	100.00

It will be observed that the net metal cost, i. e., the cost of the slabs or blooms entering into plate manufacture, constituted over 80 per cent of the total mill cost in 1918. The expense of labor was between 5 and 7 per cent of the total, or approximately one-third of the cost of converting the crude metal into plate.

The quoted Pittsburgh price for sheared plate during 1918 averaged $72.69.[1] This price would leave a considerable margin for profit, even with a liberal allowance for depreciation and for general administration and selling expenses, items not embraced in the tabulations above given. As already indicated, the American prices of ordinary tank and ship plate have in recent years been materially lower than those prevailing in England.

Iron and steel plate made from crucible and electric-furnace steel forms a small part of the country's consumption. In the manufacture of this plate some foreign countries have certain advantages over the United States. The steel used in the manufacture of this product is of superior grade and often made out of charcoal or the very best blast-furnace pig iron. For some reason not well known, certain Swedish irons are superior to the ordinary pig irons produced in the United States and make better steel. Much of this iron is exported to England, where it is manufactured into plate, and some of it is worked up into finished product in Sweden.

Another factor in this competitive situation is the increasing use of the electric furnace in steel manufacture. In so far as the power furnished is steam generated, other countries have no natural advantages over the United States. The resort to hydroelectric power gives such countries as Sweden, Norway, France, and Canada some advantages. The United States is endowed with enormous water power, but the union of high heads with a steady flow of water is scarce compared with the countries named. (See Report on Ferro Alloy Industries.)

TARIFF CONSIDERATIONS.

The manufacturer of ordinary iron and steel plate in the United States has at present nothing to fear from foreign competition. The producer of plate made of crucible or electric-furnace steel meets a more formidable competition from his foreign rivals, who in some countries have certain advantages in securing better iron or cheaper electric power. That iron and steel plate manufacture, on the whole, is well established in the United States is shown by the small importation and by a relatively large export trade.

The revenue derived from duties on iron and steel plate does not yield a large income for the Government under the present tariff (see infra), and an increase in rates is likely to reduce the already small importation to such an extent as largely to counteract the effect of any increase in duties.

As there are certain broad differences in the uses of most plates and sheets, a clearer line of division between the two is desirable. Regard might be had concerning certain finishing processes used in preparing plates and sheets for the market. (See pars. 109 and 110 and Survey on Iron and Steel Sheets.)

Differences in the kind or specification of the steel used in plate manufacture deserves some consideration in the classification of plates, as, for example, putting boiler plate and skelp together in one paragraph (see tariff of 1913, par. 105, and tariff of 1909, par. 122), while separating these from ordinary plates and sheets made of Bessemer and open-hearth steel (see tariff of 1913, par. 110, and tariff of 1909, par. 131).

[1] The price fixed by the War Industries Board was 3.25 cents per pound, or $72.80 per gross ton. In *December the price* dropped to $71.46 per gross ton, making the average for the year 1918, $72.69.

Skelp, flue and pipe—Production in United States—States.

[From Federal census.]

States.	1899		1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
			Tons.		*Tons.*		*Tons.*	
Pennsylvania			1,058,588		1,087,502	$34,273,085	860,969	$24,001,966
Ohio			211,624		739,761	22,198,365	955,597	24,478,568
West Virginia			192,644		201,794	6,060,225	114,020	3,013,905
Illinois, Connecticut, and New York	(1)	(1)	94,834	(2)				
All other					55,229	1,983,053	30,258	948,864
Total			1,557,690	46,780,202	2,084,286	64,514,728	1,960,844	52,443,303

[1] Production not reported separately, but included with iron and steel hoops, bands, and cotton ties.
[2] Not reported by States.

Plates (No. 12 and thicker)—Production in United States—States.

[From Federal census.]

States.	1899 [1]		1904 [1]		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*		*Tons.*	
Pennsylvania	1,245,843	$56,984,914	1,297,086		1,683,328		1,452,489	
Ohio	308,092	16,110,691	364,790		372,697		283,884	
Indiana	120,954	6,223,460	23,947		57,946		240,936	
New York				(2)	64,744	(2)	27,616	(2)
West Virginia	39,215	2,005,291	34,036		20,929		8,183	
Kentucky	23,419	1,401,709	33,921		2,374			
All other	144,557	6,350,964	496,703		190,126		170,667	
Total	1,882,080	89,077,029	2,250,483	98,769,807	2,392,144		2,183,775	62,768,579

[1] Iron and steel boiler and other plates and sheets (except nail and tack plates and armor plates).
[2] Not reported by States.

Nail and tack plate—Production in United States—States.

[From Federal census.]

States.	1899		1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*	
Pennsylvania	42,217	$1,087,103			37,802	$1,469,504	31,318	$1,299,420
Massachusetts	16,370	554,170						
Ohio	16,094	680,644						
West Virginia	11,098	398,074						
Kentucky	5,607	201,703						
All other	6,280	194,864			30,755	1,070,518	18,984	708,888
Total	97,664	3,116,558	86,601	$2,462,076	68,557	2,540,022	50,302	2,008,308

Iron and steel plates [1]*—Production in United States.*

[From Annual Statistical Report of the American Iron and Steel Institute, 1918.]

Years.	Iron.	Steel.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*
1910	37,763	2,769,965	2,807,728
1911	46,147	2,288,194	2,334,341
1912	33,349	3,001,851	3,035,200

[1] The dividing line between plates and sheets is fixed at No. 12 B. W. G., or approximately one-eighth inch thick. *Where the rolled material is thinner than* No. 12 B. W. G. it is called a sheet.

Iron and steel plates (universal and sheared)—Production in United States.

[From Annual Statistical Report of the American Iron and Steel Institute.]

Years.	Universal plates.	Sheared plates.		Total.
		Rolled on single stands.	Roughened and finished on separate stands.	
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*
1913	1,158,416	1,305,627	448,727	3,002,770
1914	766,113	1,170,338	175,970	2,112,421
1915	954,852	1,626,559	296,640	2,878,051
1916	1,224,234	1,982,863	470,287	3,677,384
1917	1,195,199	2,396,365	566,674	4,158,238
1918	1,234,782	3,125,049	760,077	5,119,908
1919	992,054	2,373,696	525,571	3,891,321

Iron and steel plates—Production in principal foreign countries.[1]

Country.	1913	1914	1915	1916	1917	1918
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Great Britain					1,326,584	1,345,498
Germany		1,172,966	966,898			
Canada	[2] 392,340	[2] 218,125	[2] 328,738	[2] 707,823	[2] 745,162	[2] 714,021

[1] Mineral Industry, 1915 and 1918.
[2] Includes sheets, merchant bars, tie-plate bars, etc.
[3] Includes sheets, merchant bars, tie-plate bars, etc. Figures taken from the Annual Statistical Reports of the American Iron and Steel Institute, 1917 and 1918.

Iron and steel sheets and plates (dutiable)—Imports by countries.

FISCAL YEARS.

Imported from—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	6,371,455	$295,997	4,940,369	$262,393	3,593,574	$228,508
Germany	3,045,640	166,318	2,455,338	40,959	1,138,426	19,181
Canada	155,039	4,933	84,500	5,614	142,779	9,559
Belgium	5,324,812	66,392	294,820	4,264	308,044	4,323
Sweden	256,134	16,581	115,501	5,965	304,851	9,616
Russia in Europe	166,701	9,218	65,523	3,878	147,981	7,256
All other	29,111	11,019	159,684	4,287	14,009	449
Total	15,348,892	570,458	8,115,735	327,360	5,649,664	278,872

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	5,138,003	$357,574	5,018,126	$368,202	3,226,593	$227,115
Germany	520,269	13,258	1,100,594	40,948	857,706	9,012
Sweden	18,225	962	388,336	27,744	476,360	35,889
Canada	1,845,419	37,926	737,425	27,559	107,275	7,221
Mexico			196,585	6,112		
Belgium	681,382	10,296	433,003	5,897	1,059,404	11,999
All other	138,520	8,149	12,205	1,506	7,359	780
Total	8,341,818	428,465	7,886,274	477,968	5,734,697	291,969

Iron and steel sheets and plates (dutiable)—Imports by countries—Continued.

FISCAL YEARS—Continued.

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	3,035,966	$257,371	3,301,641	$412,803	2,581,085	$430,832
Sweden	413,145	20,887	259,310	19,794	1,860,985	308,856
Canada	293,408	8,282	75,154	2,984	93,259	8,043
Denmark			61,759	4,130		
Mexico	70,892	1,986	32,689	1,092	49,641	2,550
All other	14,250	709			114,600	2,965
Total	3,827,661	289,235	3,730,553	440,863	4,699,570	753,246

CALENDAR YEARS.

Imported from—	1918		1919	
	Pounds.		*Pounds.*	
United Kingdom	1,572,706	$318,563	1,803,385	$367,642
Sweden	1,378,692	298,704	550,334	66,834
Canada	131,055	12,326	88,836	14,269
Denmark			10,740	6,528
France			484	275
Panama	114,000	2,965		
Australia			91	11
Total	3,397,053	632,558	2,453,870	455,559

Boiler or other plate iron or steel (except crucible plate steel and saw plates) and skelp iron or steel sheared or rolled in grooves—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ cent per pound to 25 per cent.	641,038	$9,194.00	$4,044.71	$0.014	43.99
1908	do	582,089	9,089.00	3,658.52	.016	40.25
1909	do	334,592	6,217.00	2,374.71	.015	38.19
1910 [1]	25 per cent	280	15.00	3.75	.054	25.00
1910 [2]	$\frac{1}{10}$ cent per pound to 20 per cent.	1,883,616	22,001.00	9,461.54	.012	43.01
1911	$\frac{1}{10}$ cent per pound to 20 per cent.	486,111	6,448.00	2,429.29	.013	37.68
1912	do	429,027	5,371.00	2,034.65	.013	37.88
1913	do	715,253	12,678.00	3,918.06	.018	30.90
1914 [3]	$\frac{1}{10}$ cent per pound to 20 per cent.	158,252	2,631.00	830.57	.017	31.57
1914 [4]	12 per cent	555,896	6,822.00	818.70	.012	12.00
1915	do	740,090	8,461.00	1,036.92	.011	12.00
1916	do	30,385	1,814.00	217.68	.060	12.00
1917	do	32,689	1,092.00	131.04	.033	12.00
1918	do	122,672	4,981.00	597.72	.041	12.00
1919	do	27,059	6,463.00	775.56	.24	12.00
1918 [5]	do	145,318	10,832	1,299.84	.074	12.00
1918 [6]	Free, Sec. IV, J5	482,790	26,318		.054	
1919 [5]	12 per cent	6,596	797	95.64	.121	12.00
1919 [6]	Free, Sec. IV, J5	58,620	8,290		.141	

[1] July 1 to Aug. 5, 1909.
[2] Aug. 6, 1909, to June 30, 1910.
[3] July 1 to Oct. 3, 1913.
[4] Oct. 4, 1913, to June 30, 1914.
[5] Calendar years.
[6] For construction and equipment of vessels.

Sheets of iron or steel, common or black, and skelp iron or steel, not sheared or rolled with grooves—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ to $\frac{1}{8}$ cent per pound.	1,529,727	$30,533.00	$11,086.92	$0.02	36.31
1908	$\frac{1}{10}$ cent to $1\frac{1}{10}$ cents per pound.	1,061,704	21,910.00	7,481.92	.02	34.15
1909	$\frac{1}{10}$ cent to $1\frac{1}{10}$ cents per pound.	1,030,646	21,332.00	8,321.88	.021	39.01
1910 [1]	$\frac{1}{10}$ cent to $1\frac{1}{10}$ cents per pound.	181,174	3,389.00	1,411.41	.019	41.65
1910 [2]	$\frac{1}{10}$ cent per pound to 30 per cent.	1,873,795	41,138.00	11,289.89	.022	27.44
1911	do	3,340,675	55,886.00	18,079.64	.017	32.35
1912	do	1,468,445	33,535.00	9,217.99	.023	27.49
1913	do	1,085,267	28,118.00	6,858.88	.026	24.39
1914 [3]	do	228,652	5,749.00	1,261.96	.025	21.95
1914 [4]	12 per cent	505,441	11,394.00	1,367.28	.023	12.00
1915	do	1,261,240	23,175.00	2,781.00	.018	12.00
1916	do	54,387	1,743.00	209.16	.032	12.00
1917	do	28,575	1,883.00	225.96	.066	12.00
1918	do	7,160	1,796.00	215.52	.251	12.00
1919	do	10,950	729.00	87.48	.067	12.00
1918 [5]	do	6,610	1,774.00	212.88	.268	12.00
1919 [5]	do	20,066	1,287.00	154.44	.064	12.00

[1] July 1 to Aug. 5, 1909.
[2] Aug. 6, 1909, to June 30, 1910.
[3] July 1 to Oct. 3, 1913.
[4] Oct. 4, 1913, to June 30, 1914.
[5] Calendar years.

Sheets and plates (except saw plates) when made by the Bessemer, Siemens-Martin, open-hearth, or similar process, not containing alloys such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys [1]*—Imports for consumption—Revenue.*

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ cent to $4\frac{1}{10}$ cents per pound.	2,154,623	$160,673.00	$33,639.32	$0.074	20.93
1908	do	2,668,528	198,940.00	41,548.40	.075	20.89
1909	$\frac{1}{10}$ cent to $4\frac{1}{10}$ cents per pound.	4,427,851	360,279.00	71,647.57	.081	19.89
1910 [2]	$\frac{1}{10}$ cent to $4\frac{1}{10}$ cents per pound.	459,980	34,765.00	7,124.74	.075	20.49
1910 [3]	$\frac{1}{10}$ cent per pound to 20 per cent.	8,072,542	303,960.00	63,549.17	.038	20.91
1911	do	3,130,645	165,346.00	34,865.34	.053	21.09
1912	$\frac{1}{10}$ cent per pound to 20 per cent.	2,289,789	152,141.00	30,285.85	.066	19.91
1913	do	5,351,022	278,620.00	55,005.50	.052	19.74
1914 [4]	$\frac{1}{10}$ cent per pound to 20 per cent.	1,287,650	75,617.00	15,174.45	.059	20.07
1914 [5]	8 per cent	2,146,798	112,687.00	9,014.96	.052	8.00
1915	do	1,735,447	91,157.00	7,292.56	.053	8.00
1916	do	2,231,279	154,197.00	12,335.76	.069	8.00
1917	do	2,239,511	208,078.00	16,646.24	.093	8.00
1918	do	3,345,681	386,735.00	30,938.80	.116	8.00
1919	do	830,549	104,925.00	8,394.00	.126	8.00
1918 [6]	do	2,249,963	271,342.00	21,707.36	.119	8.00
1919 [6]	do	1,248,931	142,784.00	11,422.72	.114	8.00
1919 [7]	Free, Sec. IV, J5	70,314	11,598.00			

[1] Saw plates are included prior to 1910.
[2] July 1 to Aug. 5, 1909.
[3] Aug. 6, 1909, to June 30, 1910.
[4] July 1 to Oct. 3, 1913.
[5] Oct. 4, 1913, to June 30, 1914.
[6] Calendar years.
[7] For the construction and equipment of vessels.

l plates (except saw plates) when made by the crucible, electric, or cementation either with or without alloys, and finished by rolling, hammering, or otherwise— s for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
	15 per cent	172,125	$16,867.00	$2,530.09	$0.098	15.00
	do	237,974	25,421.00	3,813.15	.107	15.00
	do	571,392	68,512.00	10,276.80	.119	15.00
	do	1,250,676	204,826.00	30,723.90	.164	15.00
	do	561,876	120,886.00	18,132.90	.215	15.00
	do	572,738	151,254.00	22,688.10	.264	15.00
	do	218,066	56,639.00	8,495.85	.260	15.00
	do	531,322	136,614.00	20,492.10	.257	15.00

[1] Oct. 4, 1913, to June 30, 1914. [2] Calendar years.

Iron sheets and plates—Domestic exports. [1]

FISCAL YEARS.

orted to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
ngdom	1,696,265	$41,630	126,973	$3,774	125,013	$3,380
	50,580,262	1,264,985	47,788,428	1,139,918	87,581,228	2,030,648
	35,987,635	906,851	39,978,998	993,238	72,199,061	1,778,283
	19,870,800	603,595	18,185,609	580,167	20,267,209	608,372
	13,248,174	345,306	16,968,697	450,974	15,610,457	419,748
	1,211,423	32,489	2,453,249	78,076	10,037,788	317,776
	9,302,812	233,152	3,636,185	100,923	9,997,443	259,951
	2,103,399	56,301	2,495,788	68,117	2,761,296	74,466
dia	6,848,500	169,888	7,021,066	178,334	40,494,003	1,009,938
and Australia	12,330,360	419,720	21,466,402	737,414	44,498,533	1,475,609
Islands	19,824,265	559,062	17,335,207	520,824	18,454,601	544,589
	14,143,435	467,909	19,700,362	676,888	25,351,158	833,602
	1,009,607	31,825	5,528,636	167,000	5,882,060	185,064
	26,035,367	727,813	29,866,639	849,938	64,268,129	1,779,403
l	214,192,504	5,860,526	232,552,239	6,545,585	417,527,979	11,320,829

rted to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
ngdom	766,497	$16,617	190,448	$4,555	796,353	$15,24
	31,136,170	692,434	19,526,406	434,525	12,338,179	280,54
	16,545,442	393,676	2,447,767	59,869	3,316,061	84,08
	3,010,130	77,823	887,627	27,251	424,927	15,31
	1,812,015	34,629	452,268	12,275	653,806	15,71
	2,189,556	60,603	904,562	25,741	1,186,898	34,83
	350,344	8,427	221,005	5,537	677,802	10,63
	24,620	611	152,155	4,151	233,823	5,89
	7,546,406	226,121	146,501	4,768	489,963	11,24
	722,669	16,184	97,001	2,248	152,361	3,07
lia	2,549,171	53,106	66,636	1,519	81,005	1,78
	5,084,804	141,223	614,399	18,052	986,580	26,93
l	71,737,824	1,721,454	25,706,775	600,491	21,337,758	505,145

s "Galvanized" prior to 1913.

Iron sheets and plates—Domestic exports—Continued.

FISCAL YEARS—Continued.

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	8,036,665	$166,598	5,720,962	$195,337	1,461,096	$97,397
Canada	36,436,399	888,303	46,995,442	1,799,700	57,787,247	3,185,674
France	5,118,134	109,170	3,067,308	141,334	3,907,421	252,251
Argentina	15,880,575	341,966	11,165,536	340,600	8,804,356	613,035
Japan	6,474,496	143,942	8,887,223	360,804	17,465,171	1,441,504
Australia	2,998,434	58,318	924,822	35,643	3,008,754	223,054
Mexico	1,142,217	39,166	1,366,215	76,653	1,155,540	87,271
Cuba	2,199,911	68,404	4,844,315	197,929	1,523,677	113,717
Brazil	2,395,382	65,972	6,597,694	290,798	2,378,291	179,782
Chile	2,401,623	61,839	1,119,389	42,728	2,544,051	188,869
China	2,238,412	79,694	757,018	31,731	2,107,971	173,368
Panama	522,156	11,808	194,396	7,755	151,175	15,192
Philippine Islands	162,551	5,062	226,522	14,041	1,124,927	90,167
British India	44,975	814	10,701,690	400,481	1,465,694	88,391
All other	9,419,435	219,687	15,223,882	655,499	18,519,419	1,499,397
Total	95,491,365	2,260,743	117,792,614	4,581,033	123,404,790	8,249,169

CALENDAR YEARS.

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
United Kingdom	2,673,054	$130,226	1,791,657	$80,489
Canada	39,953,614	2,049,748	23,886,744	1,112,009
France	7,364,155	371,372	15,294,211	702,935
Argentina	2,508,625	189,674	1,829,336	101,307
Japan	14,465,504	1,021,639	21,636,977	1,237,491
Australia	5,738,361	414,538	5,007,683	384,434
Mexico	704,067	44,891	1,662,924	108,118
Cuba	1,004,738	79,631	1,326,785	83,710
Brazil	1,035,397	78,769	4,468,754	301,301
Chile	769,246	60,891	1,337,473	90,871
China	1,199,291	113,314	1,371,665	96,622
Panama	18,562	1,423	87,381	5,055
Philippine Islands	1,266,715	98,972	1,870,268	108,694
British India	453,331	37,774	1,171,177	72,908
All other	12,138,732	1,002,233	6,612,250	401,513
Total	91,293,392	6,315,095	89,358,285	4,837,547

Steel sheets and plates—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	12,112,795	$303,744	9,484,080	$233,411	18,819,009	$427,041
Germany			839,209	14,793	1,627,615	30,918
Canada	256,554,413	4,875,466	348,111,844	6,437,314	418,414,380	7,457,232
Japan	1,131,829	20,422	13,556,502	239,864	56,428,028	1,519,123
Australia	5,258,172	78,701	18,676,713	284,835	21,814,360	342,285
Cuba	5,418,342	108,490	6,375,728	131,394	9,604,646	153,883
Panama	4,117,528	87,953	2,831,970	46,547	14,968,119	300,004
Chile	2,686,029	58,940	23,196,938	604,727	41,758,486	1,044,814
Mexico	16,294,770	400,383	13,273,151	297,397	6,755,529	151,356
British India	1,149,445	27,595	422,719	8,744	3,997,170	66,624
Philippine Islands	658,197	12,798	1,922,629	34,684	2,806,584	52,163
All other	6,941,179	145,571	10,614,564	230,710	27,691,857	752,113
Total	312,322,699	6,120,065	449,306,653	8,563,840	624,782,763	12,327,861

Steel plates [1]*—Domestic exports (fiscal years).*

Exported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	19,263,270	$308,688	7,239,491	$149,193	18,536,803	$302,190
Germany	38,400	767	1,424,554	275,982	371,490	73,700
Canada	441,057,377	6,708,433	283,684,159	4,245,769	155,160,810	2,253,580
France	63,970	1,214	40,110	1,644	688,478	12,224
Italy	644,565	28,138	46,020	4,586	3,111,310	325,741
Argentina	2,043,214	34,363	1,662,807	28,399	152,204	2,944
Japan	34,151,935	618,628	4,137,969	73,983	21,286,245	356,466
Australia	33,795,345	517,039	14,198,002	222,671	25,188,032	366,949
Cuba	10,504,535	178,209	10,506,095	172,144	9,925,062	135,752
Panama	6,314,372	133,744	6,067,540	102,325	7,039,157	107,682
Chile	4,008,851	67,529	7,557,603	130,276	2,564,958	37,022
China	1,479,680	37,170	253,165	4,060	4,369,598	59,639
British India	4,015,246	74,074	4,147,136	75,730	3,912,953	52,508
Philippine Islands	1,742,415	41,797	4,879,326	116,554	5,245,074	77,080
All other	30,698,213	491,312	13,428,701	383,238	20,015,102	308,495
Total	589,821,388	9,239,105	359,272,678	5,986,554	277,567,476	4,471,972

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	54,619,113	$982,123	17,018,173	$430,201	72,929,348	$2,802,358
Canada	269,663,321	5,113,976	305,426,203	11,208,694	285,540,028	14,027,895
France	15,610,417	328,491	32,674,063	1,275,120	126,683,513	7,487,633
Italy	8,938,091	195,313	46,755,253	1,816,758	111,277,146	5,004,016
Argentina	2,705,979	60,346	4,736,529	196,410	7,967,034	759,976
Japan	121,554,642	2,263,495	392,600,700	15,396,284	359,416,978	30,356,176
Australia	42,713,380	624,004	12,982,107	370,857	4,991,769	253,735
Cuba	11,464,105	232,182	15,700,968	517,147	5,822,125	383,272
Panama	10,490,601	204,524	13,923,560	541,488	2,192,507	131,116
Chile	5,900,276	112,940	6,621,032	252,930	5,346,428	454,892
China	8,476,173	166,426	17,773,850	786,461	18,872,498	1,486,216
British India	6,693,730	106,549	13,601,888	589,962	16,121,938	1,156,912
Philippine Islands	3,630,489	76,687	1,758,706	71,416	5,801,214	423,632
All other	45,206,844	876,357	62,413,608	2,660,898	52,491,180	4,280,942
Total	607,667,161	11,343,413	943,986,640	36,114,626	1,075,453,706	69,008,771

[1] Included in "Steel sheets and plates" prior to 1913.

Steel plates—Domestic exports (calendar years).

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
United Kingdom	147,658,543	$4,969,576	72,028,314	$2,040,519
Canada	388,006,094	15,586,817	416,904,330	12,867,080
France	171,834,443	9,568,245	143,872,797	6,462,970
Italy	143,480,272	6,475,610	141,578,805	4,764,756
Argentina	1,948,780	179,887	9,260,067	396,590
Japan	269,686,510	19,091,298	545,851,094	19,657,459
Australia	11,414,024	502,790	15,474,365	516,275
Cuba	5,434,075	322,853	14,401,240	552,079
Panama	1,981,013	100,957	957,826	39,082
Chile	3,803,832	320,950	8,005,092	365,801
China	6,737,912	696,210	47,440,805	1,730,092
British India	8,736,411	695,180	18,164,858	800,777
Philippine Islands	7,208,916	492,008	5,150,391	290,840
All other	68,474,899	5,706,247	151,338,653	6,316,731
Total	1,236,405,744	64,678,628	1,590,428,647	56,701,651

Tank plates—Prices, in cents per pound, at Pittsburgh.

[From The Iron Age.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1.55	1.40	1.15	1.75	1.20	1.10	2.25	4.45	3.25	3.00	[illegible]
February	1.55	1.40	1.11	1.71	1.20	1.10	2.56	4.88	3.25	3.00	[illegible]
March	1.55	1.40	1.12	1.70	1.18	1.10	3.10	5.25	3.25	2.91	[illegible]
April	1.55	1.40	1.21	1.68	1.15	1.15	3.56	5.88	3.25	2.65	[illegible]
May	1.51	1.39	1.25	1.60	1.12	1.15	3.75	6.60	3.25	2.65	[illegible]
June	1.48	1.35	1.25	1.45	1.10	1.16	3.63	8.00	3.25	2.65	[illegible]
July	1.41	1.35	1.30	1.45	1.10	1.22	3.44	9.00	3.25	2.65	[illegible]
August	1.40	1.34	1.35	1.44	1.18	1.26	3.70	8.80	3.25	2.65	[illegible]
September	1.40	1.29	1.47	1.40	1.20	1.34	4.00	8.00	3.25	2.53	[illegible]
October	1.40	1.17	1.53	1.36	1.14	1.44	4.00	3.25	3.25	2.61	[illegible]
November	1.40	1.13	1.59	1.26	1.08	1.65	4.15	3.25	3.25	2.65	[illegible]
December	1.40	1.15	1.60	1.20	1.05	2.04	4.25	3.25	3.13	2.65	[illegible]
Average	1.47	1.31	1.33	1.50	1.14	1.31	3.53	5.88	3.24	2.72	[illegible]
Monthly average:											
Highest	1.55	1.40	1.60	1.75	1.20	2.04	4.25	9.00	3.25	3.00	[illegible]
Lowest	1.40	1.13	1.11	1.20	1.05	1.10	2.25	3.25	3.13	2.65	[illegible]

Skelp, grooved steel—Prices, in cents per pound, at Pittsburgh.

[From The Iron Age.]

Month.	1917	1918	1919	1920
	Cents.	*Cents.*	*Cents.*	*Cents.*
January	2.85	2.90	2.70	[illegible]
February	3.31	2.90	2.70	[illegible]
March	3.56	2.90	2.64	[illegible]
April	4.69	2.90	2.45	[illegible]
May	3.50	2.90	2.45	.....
June	4.00	2.90	2.45	.....
July	4.00	2.90	2.45	.....
August	4.00	2.90	2.45	.....
September	[1] 4.00	2.90	2.45	.....
October	2.90	2.90	2.45	.....
November	2.90	2.90	2.45	.....
December	2.90	2.90	2.45	.....
Average	3.55	2.89	2.51	.....
Monthly average:				
Highest	4.69	2.90	2.70	.....
Lowest	2.90	2.90	2.45	.....

[1] Two quotations only.

Skelp, sheared steel—Prices, in cents per pound, at Pittsburgh.

[From The Iron Age.]

Month.	1917	1918	1919	1920
	Cents.	*Cents.*	*Cents.*	*Cents.*
January	3.00	3.25	3.00	[illegible]
February	3.81	3.25	3.00	[illegible]
March	3.81	3.25	2.91	[illegible]
April	5.38	3.25	2.65	[illegible]
May	5.50	3.25	2.65	.....
June	6.00	3.25	2.65	.....
July	6.00	3.25	2.65	.....
August	6.00	3.25	2.65	.....
September	[1] 6.00	3.25	2.65	.....
October	3.25	3.25	2.65	.....
November	3.25	3.25	2.65	.....
December	3.25	3.13	2.65	.....
Average	4.60	3.24	2.73	.....
Monthly average:				
Highest	6.00	3.25	3.00	.....
Lowest	3.00	3.13	2.65	.....

[1] *Two quotations only.*

Ship, bridge, and tank plates—Prices per ton in England and Wales.

[From The Iron and Coal Trades Review.]

Month.	1918			1919			1920		
	£ s. d.	Dollars.[1]		£ s. d.	Dollars.[1]		£ s. d.	Dollars.[1]	
				12 0 0	58.40		22 6 0	108.53	
				14 0 0	68.13		23 10 0	114.38	
				14 0 0	68.13		23 10 0	114.38	
				14 0 0	68.13		23 10 0	114.38	
				17 0 0	82.73				
	11 10 0	55.98		17 12 6	85.79				
	11 10 0	55.98		17 15 0	86.38				
	11 10 0	55.98		18 5 0	88.82				
	11 10 0	55.98		18 5 0	88.82				
	11 10 0	55.98		18 7 0	89.31				
	11 10 0	55.98		19 12 6	95.52				
	11 10 0	55.98		21 0 0	102.20				
rage				16 16 2	81.82				
thly average:									
Highest				21 0 0	102.20				
Lowest				12 0 0	58.40				

h prices reduced to dollars and cents on the basis of the normal rate of exchange (£1—$4.8665).

S. M. boiler plates—Prices per ton.

[From The Iron and Coal Trades Review.]

Month.	1918			1919			1920		
	£ s. d.	Dollars.[1]		£ s. d.	Dollars.[1]		£ s. d.	Dollars.[1]	
				13 8 0	65.22		25 0 0	121.66	
				15 0 0	73.00		28 0 0	136.26	
				15 0 0	73.00		28 7 6	138.09	
				15 0 0	73.00		28 10 0	138.71	
				19 5 0	93.69				
	13 0 0	63.26		20 0 0	97.33				
	13 0 0	63.26		21 0 0	102.20				
	12 18 0	62.81		21 10 0	104.65				
r	13 0 0	63.26		21 10 0	104.65				
	13 0 0	63.26		21 12 0	105.14				
r	12 18 0	62.81		22 5 0	108.29				
	13 0 0	63.26		22 10 0	109.51				
rage				19 0 0	92.46				
thly average:									
Highest				22 10 0	109.51				
Lowest				13 8 0	65.22				

h prices reduced to dollars and cents on the basis of the normal rate of exchange (£—$4.8665).

Court and Treasury Decisions.

word "plates" as used in paragraph 135 of the act of 1897 was reted to designate, both in common parlance and in commerce, icle distinct from drawplates, being in fact the thing out of drawplates are made. (Newman *v.* United States, 2 Ct. Cust. 4; same, 159 Fed. 123.) And not to include plates manufac- into a complete commercial article, such as a so-called steel consisting of a rectangular slab incised with a pattern to be ssed upon plate glass. (Morris *v.* United States, 174 Fed. 656.) ieces of cast steel upon which machine work had been done being cast and so forming a combination of parts ready for im- te use in a cement mill. (United States *v.* Prosser, 1 Ct. Cust. 22.)

the word was held to include a slab or plate of steel with the surface engraved in a pattern, used in the manufacture of glass, the glass being pressed or rolled against the raised pat- o as to take the impression thereof. (Morris *v.* United States, ed. 774.) And polished steel plates intended to be engraved

and used in printing, and so-called monogram dies, consisting of small plates on which monograms are to be engraved. (United States v. Sellers, 166 Fed. 1022.) A steel plate 12 feet long by 59 inches wide and five-sixteenths of an inch thick, checkered on one side to prevent slipping and intended for floors of boiler rooms, the provision in paragraph 126 for "boiler or other plate iron or steel" being restricted to such plate as is used in the construction of boilers, tanks, or vessels, and can be cut, bent, and shaped. (Hill v. Wood, 163 Fed. 51.) Plates of steel sheared at a slight deviation from one-sixtieth of an inch thick, so as to insulate the same and prevent contact, were also held to come within paragraph 135. (United States v. Vandegrift, 142 Fed. 448.)

There was no litigation of importance under the act of 1909, nor under the act of 1913. In the absence of definite distinctions, arbitrary lines of demarkation have been established by the Treasury Department for the purposes of the act of 1913, between plates, bars, sheets, and bands or strips. (T. D. 34694.)

Merchandise invoiced as "saw plates" and returned by the appraiser as "crucible steel sheets suitable for band saws" was declared to be "band-saw plates," dutiable under paragraph 105 of the act of 1913 rather than under paragraph 110 (Abstract 39008), but crucible band-saw steel in long lengths was held dutiable n. s. p. f. under paragraph 110 rather than under paragraph 105. (Abstract 35993, T. D. 34604.)

Iron and steel plates—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	151	Boiler or other plate iron, sheared or unsheared, skelp iron, sheared or rolled in grooves.	1¼ cents per pound.
		Sheet iron, common or black, thinner than 1½ inches and not thinner than No. 20 wire gauge	1⅕ cents per pound.
	177	Plates of all thicknesses and widths: * * * pressed, sheared, or stamped shapes, or blanks of sheet or plate steel, or combination of steel and iron, punched or not punched; * * * all of the above classes of steel not otherwise specially provided for in this act:	45 per cent ad valorem
		Valued at 4 cents a pound or less	45 per cent ad valorem
		Above 4 cents a pound and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2¾ cents per pound.
		Valued at above 10 cents per pound	3½ cents per pound.
		Provided, That on steel circular saw plates there shall be paid 1 cent per pound in addition to the rate provided in this act.	
1890	138	Boiler or other plate iron or steel, except saw plates hereinafter provided for, not thinner than No. 10 wire gauge, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves:	
		Valued at 1 cent per pound or less	⅛ cent per pound.
		Valued above 1 cent and not above 1⅛ cents per pound	1⅛ cent per pound.
		Valued above 1⅛ cents and not above 2 cents per pound	¼ cent per pound.
		Valued above 2 cents and not above 3 cents per pound	1⅛ cents per pound.
		Valued above 3 cents and not above 4 cents per pound	1½ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2⅝ cents per pound.
		Valued above 10 cents and not above 13 cents per pound	3½ cents per pound.
		Valued above 13 cents per pound	45 per cent ad valorem
		Provided, That all plate iron or steel thinner than No. 10 wire gauge shall pay duty as iron or steel sheets.	
	146	* * * saw plates, wholly or partially manufactured; * * * plates not specially provided for in this act; * * * all of the above:	
		Valued at 1 cent per pound or less	⅛ cent per pound.
		Valued above 1 cent and not above 1⅛ cents per pound	⅛ cent per pound.
		Valued above 1⅛ cents and not above 1½ cents per pound	¼ cent per pound.
		Valued above 1½ and not above 2½ cents per pound	⅜ cents per pound.
		Valued above 2½ cents and not above 3 cents per pound	1⅛ cents per pound.
		Valued above 3 cents and not above 4 cents per pound	1½ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2⅝ cents per pound.
		Valued above 10 cents and not above 13 cents per pound	3½ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	4⅛ cents per pound.
		Valued above 16 cents per pound	7 cents per pound.

Iron and steel plates—Rates of duty—Continued.

...of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
90	152	* * * on all plates of iron or steel of whatever shape, * * * which are cold-rolled, cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish, or polish better than the grade of cold-rolled, smoothed only, hereinbefore provided for, there shall be paid 1½ cents per pound in addition to the rates provided in this act upon plates, * * *; and on steel circular-saw plates there shall be paid 1 cent per pound in addition to the rate provided in this act for steel-saw plates.	
4	114	Boiler or other plate iron or steel, except saw plates hereinafter provided for, not thinner than No. 10 wire gauge, sheared or unsheared, and skelp iron or steel sheared or rolled in grooves:	
		Valued at 1 cent a pound or less	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above 1½ cents	$\frac{1}{10}$ cent per pound.
		Valued above 1½ cents and not above 4 cents per pound	30 per cent ad valorem.
		Valued at over 4 cents per pound	25 per cent ad valorem.
		Provided, That all plate iron or steel thinner than No. 10 wire gauge shall pay duty as iron or steel sheets.	
4	122	* * * saw plates, wholly or partially manufactured; * * * plates not specially provided for in this act; * * * All of the above:	
		Valued at 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $1\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{2}{10}$ cents and not above $2\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $2\frac{1}{10}$ cents and not above 3 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 16 cents per pound	$4\frac{1}{10}$ cents per pound.
7	126	Boiler or other plate iron or steel, except crucible plate steel and saw plates hereinafter provided for, not thinner than No. 10 wire gauge, sheared, or unsheared, and skelp iron or steel sheared or rolled in grooves:	
		Valued at 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above 2 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 2 cents and not above 4 cents per pound	1 cent per pound.
		Valued at over 4 cents per pound	25 per cent ad valorem.
		Provided, That all sheets or plates of iron or steel thinner than No. 10 wire gauge shall pay duty as iron or steel sheets.	
	135	* * * saw plates, wholly or partially manufactured; * * * plates and steel in all forms and shapes not specially provided for in this act, all of the above:	
		Valued at 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $1\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{2}{10}$ cents and not above $2\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $2\frac{1}{10}$ cents and not above 3 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 16 cents per pound	$4\frac{1}{10}$ cents per pound.
	141	* * * on all plates, * * * which are cold-rolled, cold-hammered, blued, brightened, tempered, or polished, by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only, hereinbefore provided for, there shall be paid 1 cent per pound in addition to the rates provided in this act upon plates * * *; and on steel circular saw plates there shall be paid one-half of 1 cent per pound in addition to the rate provided in this act for steel saw plates.	
909	122	Boiler or other plate iron or steel, except crucible plate steel and saw plates hereinafter provided for in this section, not thinner than No. 10 wire gauge, cut or sheared to shape or otherwise, or unsheared, and skelp iron or steel sheared or rolled in grooves:	
		Valued at $\frac{1}{10}$ of 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above $\frac{1}{10}$ of 1 cent and not above 1 cent per pound	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above 2 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 2 cents and not above 3 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued at over 3 cents per pound	20 per cent ad valorem.
		Provided, That all sheets or plates of iron or steel thinner than No. 10 wire gauge shall pay duty as iron or steel sheets.	

Iron and steel plates—Rates of duty—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1909	131	* * * plates and steel not specially provided for in this section, all of the above:	
		Valued at $\frac{3}{4}$ of 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above $\frac{3}{4}$ of 1 cent and not above $1\frac{1}{10}$ cents per pound	$\frac{2}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $1\frac{2}{10}$ cents per pound	$\frac{3}{10}$ cent per pound.
		Valued above $1\frac{2}{10}$ cents and not above $2\frac{1}{10}$ cents per pound	$\frac{4}{10}$ cent per pound.
		Valued above $2\frac{1}{10}$ cents and not above 3 cents per pound	$\frac{5}{10}$ cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{4}{10}$ cents per pound.
		Valued above 7 and not above 10 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 10 cents per pound and not above 13 cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{5}{10}$ cents per pound
		Valued above 16 cents and not above 24 cents per pound	$4\frac{1}{10}$ cents per pound.
		Valued above 24 cents and not above 32 cents per pound	6 cents per pound.
		Valued above 32 cents and not above 40 cents per pound	7 cents per pound.
		Valued above 40 cents per pound	20 per centum ad valorem.
	137	* * * on all plates * * * of iron or steel of whatever shape, * * * which are cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only, hereinbefore provided for, there shall be paid $\frac{1}{10}$ of 1 cent per pound in addition to the rates provided in this section upon plates * * * of corresponding gauge or value; and on steel circular saw plates there shall be paid $\frac{1}{2}$ of 1 cent per pound in addition to the rates provided in this section for steel plates.	
1913	105	Boiler or other plate iron or steel, * * * including crucible plate steel and saw plates, cut or sheared to shape or otherwise, or unsheared, and skelp iron or steel, whether sheared or rolled in grooves, or otherwise.	12 per cent ad valorem.
	109	All iron or steel plates * * * which are cold-rolled, smoothed only, not polished, and such as are cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only.	15 per cent ad valorem.
	110	* * * plates; all the foregoing if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, * * * and similar alloys.	8 per cent ad valorem.
		* * * plates * * * all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.	15 per cent ad valorem.

MISCELLANEOUS.

PRODUCTION OF IRON AND STEEL PLATES AND SHEETS, COMPARED WITH OTHER ROLLED IRON AND STEEL PRODUCTS.

The country's output of plates and sheets has increased in amount like other rolled products, but also relatively to such products. This growth may be illustrated by comparing this output with that of other rolled products for every fifth year beginning with 1887 and for 1918, as follows: [1]

Year.	Plates and sheets.	Iron and steel rails.	Nail plate.	Wire rods.	Structural shapes.	All other finished rolled products.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1887	602,455	2,139,640	308,432	.....	.....	2,184,279	5,235,706
1892	751,460	1,551,844	201,242	627,829	453,957	2,579,482	6,165,814
1897	1,237,286	1,647,892	94,054	979,736	583,700	2,497,970	7,001,728
1902	2,665,409	2,947,933	72,926	1,574,268	1,300,326	5,383,219	13,944,116
1907	4,248,832	3,633,654	52,027	2,017,583	1,940,352	7,972,374	19,864,822
1912	5,875,080	3,327,915	45,331	2,053,553	2,840,487	9,008,475	24,656,841
1917	8,267,616	2,944,101	22,864	3,137,138	3,110,000	15,585,921	33,067,760
1918	8,709,135	2,540,892	18,310	2,562,390	2,849,969	14,385,058	31,155,754

[1] Annual Statistical Report of the American Iron and Steel Institute for 1918, p. 34.

Active plate and sheet works, 1918.[1]

States.	Total active plates.	Universal plates.	Sheared plates.		Black sheets on sheet or job mills.	Black plates on tin mills.
			Single stands.	Separate stands.		
Massachusetts	1	0	0	0	1	0
New York	6	1	3	1	3	0
New Jersey	1	0	1	0	0	0
Pennsylvania	66	16	21	10	21	15
Delaware	3	0	2	0	1	0
Maryland	2	0	1	0	0	2
West Virginia	9	0	0	1	4	7
Kentucky	2	0	0	0	2	1
Alabama	1	1	0	1	0	0
Ohio	41	4	5	4	27	11
Indiana	9	4	3	1	4	2
Illinois	2	2	1	0	1	1
Wisconsin	1	0	0	1	0	0
Missouri	1	0	0	0	1	0
Washington	1	1	0	0	0	0
California	1	1	0	0	0	0
Total	147	30	37	19	65	39

[1] Annual Statistical Report of the American Iron and Steel Institute, 1918, p. 47.

Percentage of country's output of plates and sheets produced by the United States Steel Corporation, 1916–1918.

Year.	Production of United States Steel Corporation.	Production of all other companies.	Total production.	Percentage of United States Steel Corporation.
	Gross tons.	*Gross tons.*	*Gross tons.*	
1916	3,509,199	3,944,781	7,453,980	47.08
1917	3,555,296	4,712,320	8,267,616	43.00
1918	3,808,964	4,990,171	8,799,135	43.29
1919	3,266,174	4,106,640	7,372,814	44.30

FOREIGN TARIFFS.

DOMINION OF CANADA.

No.	Article.	Rate.		
		British preferential tariff.	Intermediate tariff.	General tariff.
280	Boiler plate or iron or steel, not less than 30 inches in width, and not less than ¼ of an inch in thickness, for use exclusively in the manufacture of boilers under regulations by the minister of customs.	5 per cent	7½ per cent	7½ per cent.
281	Rolled iron or steel plates, not less than 30 inches in width and not less than ¼ inch in thickness, n. o. p. per ton.	$2 and 5 per cent	$2.75 and 7 per cent.	$3 and 7½ per cent.
282	Rolled iron or steel sheets or plates, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves, n. o. p., per ton.	$4.25 and 5 per cent.	$6 and 7½ per cent.	$7 and 7½ per cent.
282	Skelp iron or steel, sheared or rolled in grooves, when imported by manufacturers of wrought iron or steel pipe for use only in the manufacture of wrought iron or steel pipe in their own factories.	10 per cent	12½ per cent	12½ per cent.

Foreign Tariffs—Continued.

FRANCE.[1]

No.	Article.	Rate.[2] General tariff.	Rate.[2] Minimum tariff.
210	Flat sheet and plate iron or steel:	*Fr. c.*	*Fr. c.*
	Not cast and of thickness of more than 1 millimeter, per 100 kilos (N)	10 50	7 00
	In United States currency, per gross ton (N)	$20.58	$13.73
	Cast and of thickness of more than 1 millimeter, per 100 kilos (N)	11 25	7 50
	In United States currency, per gross ton (N)	$22.04	$14.69
	Flat sheet and plate iron or steel, burnished (lustries), cut or not, of a thickness of more than 1 millimeter, per 100 kilos (N)	13 00	9 00
	In United States currency, per gross ton (N)	$25.18	$17.65
	Flat sheet and plate iron or steel, cold rolled, fire whitened or blued, cut or not, of a thickness of more than 1 millimeter, per 100 kilos (N)	20 00	14 00
	In United States currency, per gross ton (N)	$39.20	$27.44

[1] The French tariffs are subject to change by means of coefficients.
[2] Additional taxes and 4 per cent included.

GERMANY.

No.	Article.	General tariff rate.
786	Sheets and plates:	
	Rough, scaled, straightened, dressed, or varnished, more than 1 millimeter in thickness, per 100 kilos.	3 marks.
	In United States currency, per gross ton	$7.24.
787	Ground, polished, lacquered, browned, or artificially oxidized, covered or not with a shiny coating of oxide, more than 1 millimeter in thickness, per 100 kilos.	5 marks.
	In United States currency, per gross ton	$12.09.

SWEDEN.

No.	Article.	Duties.
734	Plates and sheets, cut or not:	
	Not ground or polished (except by cold rolling), without coating of other metals or other surface coating, even if they are corrugated or have patterns rolled in on one side, of thickness of 3 millimeters or more, per 100 kilos	*Kronors.* 3.00
738	Ground, furnished with bright surface, free of oxide (cold-rolled), or with dull surface free of oxide (pickled), or with reflecting film of oxide (so-called luster plates), polished, painted, varnished, nickeled, lacquered, enameled, burnished, or with impressed patterns, of a thickness of 3 millimeters or more, per 100 kilos	6.00

NOTE.—In the above changes of duties into equivalent ores per gross ton in American currency, the normal rates of exchange have been used rather than those current at the present time (June, 1920).

IRON AND STEEL SHEETS.

SUMMARY.

Iron and steel sheets are thin, wide pieces of metal ranging ordinarily from 72 to 120 inches in length, from 24 to 36 inches in width, and from three-thirty-seconds to one-eightieth inch in thickness. Plates are heavier than sheets, being seven-sixty-fourths inch or more in thickness, but the uses of the two terms are not always clearly defined. Thin plates are sometimes called sheets, and sheets, tinned or prepared for tinning, are usually called plates (tin and terne plates and black plates).

Sheets are divided into black, blue annealed, and galvanized. The last is treated in another survey. Black sheets are ordinary sheets with a standard gauge one-sixty-fourth inch in thickness, used for window and door frames, ceilings, automobiles, filing cases, and the like. Blue annealed sheets are rolled one-sixteenth inch thick or heavier and have gone through an annealing process, which gives them their blue color. They are employed in the manufacture of tanks, boilers, and for other uses where heavier material is necessary than the ordinary black sheets. Black plates are sheets, cold rolled, and carefully cleaned or pickled, and used principally for tinning.

The United States is the world's largest producer of iron and steel sheets. The country's output in 1917 amounted to 4,109,378 long tons, and in 1919 to 3,481,493 long tons. Exports during the same years aggregated 180,178 and 217,367 long tons, respectively.[1]

Imports are small compared with exports, and insignificant compared with domestic output. In 1917 they amounted to 1,587 long tons, and in 1919 to 1,004 long tons.[2] At no time during the years 1910 to 1919, inclusive, did the ratio of imports to domestic production reach as high as three-tenths of 1 per cent. Considerably over half the imported material comes from Great Britain.

The price of steel sheets, standard grade (No. 28 wire gauge) is lower in this country at the present time (1921) than in the United Kingdom, which ranks next to the United States in the output of steel sheets. In Germany, the third most important producer, the industry received a serious setback on account of the war. The manufacture of tin plate practically stopped because of the inability of the German producer to secure tin, thus taking away one important demand for iron and steel sheets.

Sheet bars constitute the raw material of iron and steel sheets. The price of this material is generally quoted at approximately one-half that of common black sheets, No. 28 gauge. The labor item is an important one in the conversion cost, amounting to about one-half the difference between the quoted prices of black sheets of the gauge mentioned and of sheet bars. While wages vary with prices, reduction below the standard prevailing in other occupations for similar work will naturally be resisted if prices are forced to low levels. Per diem wages in the United States being higher than in most other countries, such resistance in the event of severe foreign competition

[1] A small tonnage of iron plates is included in these figures.
[2] Some iron and steel plate is included.

means higher proportionate labor cost with consequent diminished competitive power.

At present (1921) the United States is far ahead of other countries in the kind of equipment used. The possibility of serious foreign competition in American markets is contingent upon material improvement in the methods of production abroad. (See under "Competitive conditions.")

The classification of sheets in present and earlier tariffs is somewhat confusing. The line between plates and sheets can with advantage be made more distinct, and the application of special paragraphs to the kinds of sheets treated be made clearer. Where it is deemed advisable to vary the rates, the following general classes may be given attention: Common black sheets; sheets, polished, burnished, glanced, etc.; black plates; sheets made of crucible or electric furnace steel.

As importation has been small, the revenue derived from customs duties is not large. In 1918, when prices were high, it amounted to $72,901.60. In 1915, after the outbreak of the war, it was as low as $23,337.76. Under the act of 1909 the largest amount of revenue derived in any one year was $93,812.02, in 1910.

Iron and steel sheets—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.		Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
				Imports.	Exports.				
Fiscal year:	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Per cent.*	*Per cent.*				*Per cent.*
1910	2,147,756	5,016	235,051	0.233	10.94	$421,330	$93,812.02	$84.00	22.27
1911	2,153,708	3,043	304,401	.141	14.13	251,458	60,268.93	82.64	23.97
1912	2,839,880	1,786	465,317	.063	16.39	209,296	45,592.92	117.19	21.78
1913	2,748,267	3,043	164,946	.111	6.00	332,315	68,727.94	109.21	20.68
1914	2,606,825	2,834	158,332	.109	6.07	373,763	52,347.68	131.89	14.01
1915	4,199,643	1,977	105,592	.061	3.30	202,814	23,337.76	102.59	11.51
1916	3,776,596	1,522	140,938	.04	3.73	257,570	27,739.14	169.23	10.77
1917	4,109,378	1,587	180,178	.039	4.38	421,748	48,639.80	265.75	11.53
1918	3,679,227	1,902	231,884	.052	6.30	666,852	72,901.60	350.61	10.93
1919	3,481,493	788	215,657	.023	6.19	379,321	49,531.53	481.38	13.06
Calendar year:									
1918	3,679,227	1,335	204,177	.036	5.55	546,516	62,930.24	409.38	11.51
1919	3,481,493	1,004	217,359	.029	6.24	413,735	52,023.64	412.09	12.57

[1] Calendar year. [2] Includes some plates. [3] Includes some iron plates.

General Information.

TARIFF PARAGRAPHS, ACT OF 1913.

105. Boiler or other plate iron or steel * * * sheets of iron or steel, common or black, of whatever dimensions, whether plain, corrugated, or crimped * * *, 12 per centum ad valorem.

109. * * * sheets of iron or steel, polished, planished, or glanced, by whatever name designated * * * or which are cold-rolled, smoothed only, not polished, and such as are cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only * * *, 15 per cent ad valorem.

110. * * * sheets, * * * all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, * * * and similar alloys, 8 per cent ad valorem.

* * * sheets * * * and steel not specially provided for in this section, all the foregoing when made by the crucible, electric, or cementation process, either with or without allloys, and finished by rolling, hammering, or otherwise, 15 per cent ad valorem.

DESCRIPTION.

Sheets are thin, wide pieces of metal ranging ordinarily from three thirty-seconds to one-eightieth inch in thickness (or from No. 13 to No. 30 wire gauge).[1] As commonly sold they range in width from 24 to 36 inches and in length from 72 to 120 inches. The term plate is applied to iron and steel sheets coated with tin or terne (tin or terne plate) and to sheets treated to make them suitable for tinning (black plate). This use of the term must not be confused with plate properly so called; i. e., with flat, wide pieces of metal, No. 12 wire gauge or thicker.

Iron and steel sheets are divided into three classes—black, blue annealed, and galvanized. Black sheets are ordinary thin iron or steel sheets, most commonly used for window and door frames, ceilings, automobiles, desks, filing cabinets, and in street-car construction. The standard gauge for black sheets is No. 28 (one sixty-fourth inch thick).

Blue annealed sheets are usually rolled 16-gauge (one-sixteenth inch thick) or heavier. As they leave the finishing mill they go through the annealing mill, and this process softens the structure of the steel, removes crystallization, and imparts to the sheet a bluish appearance, as the name indicates. Blue annealed sheets are used for tanks, boilers, and the like.

Galvanized sheets are sheets coated with zinc to protect them from corrosion caused by atmospheric influences. These sheets will be treated in a separate survey.

Sheets may be classified according to certain supplementary or finishing work put upon them in addition to the heating, rolling, and shearing resulting in the manufacture of common black sheets. Black plates are sheets which have gone through certain processes of annealing, cold-rolling, and pickling in preparation for a coating of tin or terne. Other sheets ate brightened, polished, etc., preparatory to use. Sheets and plates further advanced than hot-rolled may be treated in a supplementary survey.

DOMESTIC PRODUCTION.

Sheets constitute one of the most important divisions of iron and steel products. The country's output of sheets in 1919 amounted to 3,481,493 gross tons, or about 14 per cent of the total production of rolled iron and steel.

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[1] No. 10 wire gauge (nine sixty-fourth inch thick) is sometimes used as the dividing line between plates and sheets, and this standard is adopted in the tariffs from 1890 to 1909, inclusive. See Survey on Iron and Steel Plates, pp. 12-13.

Raw material.—The raw material out of which sheets are manufactured is sheet bars[1], a modified kind of slabs. This material is not only of domestic manufacture, but is often made in the mills of the same concern producing the sheets. Sheet bars made of open-hearth steel is better suited for the manufacture of sheets than bars made of Bessemer steel.

Equipment and method of production.—Iron and steel sheets are a rolled product and the production of rolled forms is accomplished in rolling mills. A rolling mill consists of a train of rolls which in turn is composed of roll stands, each stand having at least 2 rolls set between and carried by frames called housings.

The bars to be manufactured into sheets are heated and subjected to repeated pressure between rolls, involving what is called roughing, matching, doubling and shearing, reheating, etc., until reduced to the desired thickness. Sheets prepared for tinning (black plates) are subjected to certain finishing processes necessitating great care and cleanliness. These processes consist of pickling (black and white), annealing, and cold-rolling. Sheets are also polished, glanced, etc.

Organization.—The manufacture of sheets necessitates a large outlay of capital. The largest producers of sheets and black plate now generally make their own steel ingots and sheet bars. An up-to-date rolling mill requires an outlay running into the millions of dollars. Of the total production of plates and sheets (including black plates) in this country in 1919, over 44 per cent was made in the mills of the United States Steel Corporation.[2]

Geographical distribution.—The principal producing States are Pennsylvania and Ohio. In 1918, out of 65 mills rolling black sheets 21 were in Pennsylvania and 27 in Ohio; and out of 39 mills rolling black plates on tin mills, 15 were in Pennsylvania and 11 in Ohio. Other important States making sheets are West Virginia and Indiana.

History of the industry.—The manufacture of iron and steel sheets in the United States became an important industry during the last decade of the nineteenth century. The growth of the tin-plate industry after the passage of the tariff act of 1890 gave an impetus not only to the manufacture of black plate to be used in tinning, but also to the making of all kinds of steel sheets. By the opening of the present century the yearly production had risen to approximately 1,000,000 gross tons, and by 1910 to over 2,000,000 gross tons.

Domestic production and consumption.—The annual domestic production of iron and steel sheets in 1917 and 1918 amounted to over 3,600,000 gross tons. In 1910 the country's output was 2,147,756 gross tons. The production of the country exceeds the consumption, exports being many times as large as imports. However, the greater part of the domestic output is consumed at home—the exports of steel sheets in 1918 and 1919 being only about 6 per cent of the home production. Imports are but a fraction of 1 per cent of the country's output.

Domestic exports.—In 1919 the exports of steel sheets amounted to 397,525,194 pounds (177,467 gross tons). In 1916 and 1917 it aggre-

[1] Strictly speaking, sheet bars are not bars at all, but slabs.
[2] Annual Statistical Report of the American Iron and Steel Institute for 1918, p. 68.

gated 220,208,716 pounds and 285,806,461 pounds, respectively. From about a half to two-thirds of this amount went to Canada. Other important countries taking our steel sheets are Japan, the United Kingdom, France, Australia, British India, and Chile.

In addition to steel sheets the country exports an appreciable but much smaller amount of iron sheets.

FOREIGN PRODUCTION.

Figures concerning the output of sheets in foreign countries are incomplete and fragmentary. The leading producers outside of the United States are Great Britain and Germany. The United Kingdom manufactured in 1918, 1,103,419 gross tons of plates and sheets under one-eighth inch thick, of which output 63,789 gross tons consisted of iron plates. In 1917 the corresponding figures were 945,471 gross tons, of which 49,293 gross tons were iron plates.

Recent figures for Germany are not available. During the years 1914 and 1915 the output of sheets in that country amounted to 738,805 metric tons[1] and 628,695 metric tons, respectively. During the latter part of the war the German tin-plate trade fell into a bad state as a result of the shortage of tin, and further depression was caused by the shortage of coal. Government authorities are now trying to relieve the situation by increasing the supply of coal to tin-plate mills.[2] The depression would naturally affect the demand for black plates used for tinning. The figures concerning the output of sheets in Germany for the years above cited show a marked decline during the first year of the war.

IMPORTS.

Figures published by the Government concerning the importation of sheets include some plates. The total, however, is small compared with the country's output (much less than 1 per cent). In 1910 imports amounted to 5,016 gross tons. During the years 1915 to 1919, inclusive, the annual figures varied from 788 gross tons in 1919 to 1,977 gross tons in 1915.

The principal contributing country is the United Kingdom, from which over half of the imported product comes. During the years 1910 to 1914 Germany was the next most important country furnishing our imported supply. After the outbreak of the World War importations from this source declined and Sweden became the leading contributing country next to the United Kingdom.

PRICES.

The price situation with reference to iron and steel sheets can be best illustrated by the prices quoted for No. 28 black sheets. These sheets are one-sixty-fourth inch thick and are used as a standard from which the prices of other sheets are determined. These sheets are quoted in cents per pound with Pittsburgh as a base. During the years 1910 to 1914, inclusive, the annual average price ranged from 1.88 cents per pound in 1914 to 2.30 cents per pound in 1910. During the latter part of 1915 prices began to rise. In 1916 the average was

[1] Metric tons=2,204.6 pounds. [2] Koelnische Zeitung, May 19, 1920.

.04 cents per pound, and in 1917, 5.86 cents per pound. During the itter year the monthly average for July, August, and September was .50 cents per pound. During the period from October, 1917, to December, 1918, the price of No. 28 gauge black sheets was fixed nder Government supervision at 5 cents per pound. In 1919 the price averaged 4.43 cents per pound, but rose again in 1920. During he months March to May, inclusive, it was 5.50 cents. In April, 1921, the price was 3.75 cents.

British prices at present (1921) are materially higher and show the same recent tendency to increase. British prices are quoted by the gross ton for England and Wales. Taking 24-gauge black sheets, which correspond roughly with the No. 28 grade in the United States, the British price in March and April, 1920, was £42 ($204.39) per gross ton, as against $123.20 per gross ton (or 5.50 cents per pound) in the United States, at the normal rate of exchange. In 1919 the English price averaged £23 10s. 10d. ($114.58), as against $99.23 in this country. In 1918 the price-regulating policy of Great Britain kept quotations lower in that country than the corresponding policy in the United States. It should be said in this connection that the low foreign rate of exchange would materially lessen the difference in prices between the United States and Great Britain in 1920 and even reduce the British prices in 1919 below those of the United States.[1]

TARIFF HISTORY.

Before the passage of the act of 1913 iron and steel sheets were for the most part subject to specific duties. Rates varied with the gauge, value, and degree of finish. In the tariff of 1894 "sheets of iron or steel, common or black * * * valued at 3 cents per pound or less, thinner than No. 10 and not thinner than No. 20 wire gauge," bore a duty of 0.7 cent per pound. Similar sheets "thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge," had a duty of 0.8 cent per pound, and thinner sheets, 1.1 cents per pound. "Sheet iron or sheet steel, polished, planished or glanced, by whatever name designated," was subjected to a rate of 1¾ cents per pound. Duties on "sheets not specially provided for" ranged from 0.3 cent per pound to 4.7 cents per pound, according to value.

These rates represent a material reduction from those prevailing under the acts of 1883 and 1890. Under the former act sheets not thinner than No. 20 wire gauge paid a duty of 1.1 cents per pound, and under the latter 1 cent per pound.

The act of 1897 did not make any considerable change in the rates imposed by the preceding act. A higher duty was charged on sheets thinner than No. 32 wire gauge, and the rate on "sheets of iron or steel, polished, planished or glanced," was raised from 1¾ cents per pound to 2 cents per pound.

The act of 1909 made some marked reductions in duties. The rates on "sheets of iron or steel, common or black, of whatever dimensions * * * valued at 3 cents per pound or less, thinner than No. 10 and not thinner than No. 20 wire gauge" were reduced from 0.7 cent per pound to 0.5 cent per pound, and other duties were similarly reduced. The rate on polished, planished, or glanced sheets was lowered to 1¼ cents per pound.

[1] This lower price in 1919 was an effect of the war-price regulating policy of Great Britain. In 1918 the *prices of black sheets in* England were lower than those of the United States, but the British export prices *were very much higher than* the home prices.

The act of 1913 substituted ad valorem for specific rates. These rates ranged from 8 to 15 per cent ad valorem, the lowest applying to ordinary sheets made of Bessemer or open-hearth steel, and not containing any alloys. The highest rate applied to sheets "polished, planished, or glanced, by whatever name designated * * *, or which are cold rolled and smoothed only," and to sheets made of crucible, electric, or cementation steel, or containing alloys.

In the tariff laws of France and Germany specific rates are applied. In the former country "flat sheets and plates, iron or steel," are divided into the following general classes: Common sheets and plates, not cut; common sheets and plates, cut; sheets and plates, burnished, cut or not; sheets and plates, cold rolled, fire whitened, blued, cut or not.

Each of the general classes is subdivided into several grades, according to the thickness of the sheets or plates, the rates increasing as the sheets become thinner. (See under "Wire gauges.")

COMPETITIVE CONDITIONS.

An important item in the expense of manufacturing iron and steel sheets is labor cost. According to figures published by the Commissioner of Corporations in 1913 for the years 1902–1906,[1] over one-fourth of the total book cost of producing ordinary black sheets out of sheet bars was estimated to be labor cost. About 58 per cent of this total was represented by the expense of securing sheet bars. Over 60 per cent, therefore, of the total conversion cost was assigned to labor.

The figures published by the Bureau of Corporations represent the relative importance in the prewar period of the labor item in the manufacture of black sheets. During the war prices and costs advanced very materially. The labor cost has remained as in prewar times, a large percentage of the total expense, the absolute amount depending upon the invoiced selling price. Selling price and cost vary with gauge, increasing as the sheets get thinner. When the actual average invoiced selling price of 26, 27, and 28 gauge plain sheet steel, f. o. b. mill, is $2.15 per 100 pounds, the tonnage rate of wages paid to the principal men directly employed in the manufacture of sheets, according to contracts made between sheet-producing companies and the Amalgamated Association of Iron, Steel, and Tin Workers, are as follows:[2]

Wages per ton of 2,240 pounds.

Workers.	Gauge.			Workers.	Gauge.		
	25-26	27	28		25-26	27	28
Roller	$2.664	$2.895	$3.081	Catcher	$1.015	$1.103	$1.175
Heater	1.220	1.326	1.411	Matcher	.794	.862	.919
Heater's helper	.802	.936	.907	Doubler	.746	.811	.862
Shearman	1.162	1.263	1.343				
Pair hooter	.835	.908	.966	Total	10.221	11.107	11.822
Rougher	.923	1.003	1.068				

[1] Report of Commissioner of Corporations on the Steel Industry, Pt. III, p. 251. For an itemized statement of the cost of manufacturing black sheets according to this report. (See under "Cost of production.")

[2] These figures are taken from the Iron and Coal Trades Review (London), July 2, 1920, p. 4, and are part of a contribution by W. T. Griffiths, an official of the Iron and Steel Confederation of Great Britain, who visited the United States in 1919 and wrote a report of his investigation of American conditions in the Journal of the Iron and Steel Confederation.

These wages advance 1½ per cent for each worker with each 5 cents per 100 pounds advance in price above $2.15 and decrease 1½ per cent with each decline of 5 cents per 100 pounds till $1.80 is reached. Local conditions which prevent the full application of the general scale modify this arrangement in certain places. Wages in such cases are affected by other contracts through the proper officials of the Amalgamated Association of Iron, Steel, and Tin Workers.

The labor above tabulated constitutes between one-fourth and one-fifth of the base selling price. Certain supplementary labor would increase slightly this proportion of labor cost. The price of sheet bars is approximately one-half that of plain black sheets of the gauges above named. The labor cost of converting sheet bars into common black sheets, therefore, is not far from one-half the difference between the price of sheet bars and prices of ordinary black sheets, Nos. 26–28 gauge.

As the prices of steel sheets in 1919 for which the above rates were tabulated were greatly in excess of $2.15 per 100 pounds, the wage costs outlined above were correspondingly increased. The proportion of labor cost to selling price remains nearly the same.[1]

The relatively large proportion of labor cost in the total expense of manufacturing sheets out of sheet bars is significant of the possibilities of the future. Should foreign producers adopt the high-grade equipment of American mills, this high percentage of labor cost in the total manufacturing expense would probably prove a handicap for the American producer. A British investigator speaks of American conditions as follows:

> Generally speaking, the plate mills in America (the same is true of sheets) are far ahead of ours in arrangements and output. The author has seen very few mills in this country, either from the point of view of output or labor-saving devices, that can approach the standard of equipment and efficiency of the American mills. The output will be almost incredible to the average British iron and steel worker. * * *
>
> Notwithstanding all the unquestioned advantages of their natural resources and high standard of productive equipment, the author believes the Americans are in for a serious time. Their labor troubles have only just commenced, and they have no adequate machinery for dealing with them. The manufacturers are not in that frame of mind which is helpful for the construction of such machinery with any assurance of success. This fact in itself presents to us a golden opportunity for recovery in this country if the employers will make up their minds to scrap their obsolete machinery wherever possible and substitute it with machinery of the modern type, and so give the British workman a fair chance of demonstrating that he is the best workman in the world. If the employer will give these facilities for increased output the worker must cooperate in order to get the best out of the machinery, as it will be agreed, generally, that increased output is the principal thing that is going to assist us most in recovering our foreign trade.[2]

A fact to be pointed out, which is not mentioned in the above quotation, is that the lower general per diem rate of wages paid in Great Britain will enable manufacturers, as better equipment is introduced, to keep the labor cost lower than in this country, where the general per diem rate is higher, and thereby increase their competitive power. A labor cost in Great Britain, which would be only one-sixth or one-seventh the total manufacturing expense, may, with up-to-date equipment, mean a higher per diem wage for workmen

[1] It is, in fact, a little smaller. When the price of steel sheets is low the scale of wages show a slightly larger percentage for labor cost. The figures of the Commissioner of Corporations compiled for the years 1902–1906, when prices were much lower than at present (1920), show that labor cost was a larger percentage of total cost than is probably the case now.

[2] Iron and Coal Trades Review (London), July 2, 1920, p. 5.

than now prevails in that country, and at the same time enable the English manufacturer to undersell the American producer under the existing American schedule.[1]

It must be said, however, that the above possibility will be realized only if British producers improve their equipment. At present the American manufacturer gets his sheet bars at cheaper cost than his foreign competitors and sells the finished product at a lower price.

TARIFF CONSIDERATIONS.

The United States is the largest producer of iron and steel sheets in the world, and the prices of common black sheets tend at present (1921) to be low compared with those prevailing in Great Britain, America's greatest competitor. The ratio of imports to domestic production is but a small fraction of 1 per cent, while annual exports during the years 1910 to 1919, inclusive, have ranged from 3 to 16 per cent.

The conditions of production in the United States are not unlike those obtaining in the manufacture of plate. (See Survey on Iron and Steel Plates.) The labor involved in the production of sheets forms a larger percentage of total cost than in the case of plates, and the labor element becomes proportionally more important as the sheets get thinner and as they are subjected to annealing, cold rolling, pickling, etc.

With the introduction of better equipment in foreign countries, the relatively high percentage of the labor item in cost of manufacture may work to the advantage of a country having in general a lower standard of living than obtains in the United States, as shown above. (See "Competitive conditions.")

Plates and sheets are not properly separated under the tariff of 1913, or in the published trade statistics of Commerce and Navigation. The distinction between these two classes of products is of little value in some lines where sheets and plates are employed indifferently, but for general uses as well as in certain variations of in the character of manufacture and finishing processes preparatory to putting the commodity on the market it is of economic and tariff value. Plates are used where strength and rigidity are necessary, while sheets are employed where these qualities are not so important. The greater amount of rolling required to make sheets and the supplementary operations essential in the case of black plates to prepare the material for sale or for tinning adds much to the cost, and especially to the proportion of labor in the total cost.

Where duties are specific, rates might be graduated according to gauge and according to the supplementary operations employed on certain sheets, like annealing, cold rolling, pickling, etc. Compensatory duties might be allowed in the case of sheets made of crucible or electric furnace steel or alloys where additional duties have already been allowed upon such steels.

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[1] It is true that the wage rates in the United States vary with prices. When, however, a minimum price for sheets Nos. 26-28 of $1.80 per 100 pounds is reached, the schedule changes. Owing to a relatively high per diem wage scale in the United States, there would be considerable resistance offered toward any reduction below certain levels whatever may be the decline of prices, thus forcing a higher proportionate labor cost when prices are low.

Black plates or sheets for tinning—Production in United States.

[From Federal Census.]

State.	1899		1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*	
Pennsylvania	178,574	$9,423,900	248,569	(1)	308,738	$15,400,384	564,539	$23,744,024
Ohio				(1)	111,156	5,808,639	176,835	7,424,689
West Virginia				(1)	111,152	4,887,291	200,825	8,803,540
Illinois	14,491	905,992		(1)				
All other	200,949	10,637,913	255,456		100,389	4,799,653	69,739	3,174,788
Total	391,014	20,967,805	504,025	$25,297,079	631,435	30,955,967	1,011,938	43,147,041

[1] Figures not available.

Black sheets (not including black sheets for tinning—Production in United States.

[From Federal Census.]

State.	1899 [1]		1904 [1]		1909 [2]		1914 [3]	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*	
Illinois	81,497	$2,515,793		(4)				(4)
Pennsylvania	1,067,269	47,561,014	1,297,086	(4)	2,057,176	$78,938,359	447,938	(4)
Ohio	236,931	12,359,818	364,790	(4)	755,010	33,800,603	705,113	(4)
West Virginia			34,036	(4)	98,322	4,349,096	92,091	(4)
Indiana	36,696	1,921,938	23,947	(4)	84,999	3,901,422	117,717	(4)
New York					83,205	3,018,984	32,391	(4)
All other	65,673	3,750,660	136,610		254,021	9,283,929	120,221	
Total	1,488,066	68,109,223	1,856,469	$77,802,001	3,332,733	133,272,393	1,515,474	$67,017,384

[1] Includes both plates and sheets; figures for different gauges are not available.
[2] Some plates are included, as 2,392,114 gross tons constitute plates 16-gauge and thicker.
[3] Sheets 13-gauge and thinner.
[4] Figures not available.

Iron and steel sheets—Production in United States.[1]

[From Annual Statistical Report of the American Iron and Steel Institute.]

Year.	Iron.	Steel.	Total.	Black sheets rolled on sheet or jobbing mills.	Black plates rolled on tin mills.		Total sheets.
					For tinning.	Other specialties.	
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1910	53,355	2,094,401	2,147,756				
1911	43,280	2,110,428	2,153,708				
1912	41,095	2,798,185	2,839,280				
1913				1,716,998	827,286	204,033	2,748,267
1914				1,427,627	938,181	241,017	2,606,825
1915				1,896,786	1,093,345	269,512	3,199,643
1916				2,249,597	1,283,802	243,197	3,776,596
1917				2,367,752	1,513,772	227,854	4,109,378
1918				2,073,639	1,502,690	102,898	3,679,227
1919				2,099,810	1,195,436	216,217	3,181,493

[1] Sheets No. 13 and thinner.

Iron and steel sheets—Production in principal foreign countries.[1]

Country.	1913	1914	1915	1916	1917	1918
	Tons.[2]	*Tons.*[2]	*Tons.*[2]	*Tons.*[2]	*Tons.*[2]	*Tons.*[2]
Austria-Hungary	59,407			104,886		
Belgium	118,590	70,430	15,620	28,410	12,660	
Germany		738,805	625,695			
Sweden	34,484	24,312	29,880	29,359	30,195	
United Kingdom:						
Steel sheets[3]			1,367,577	780,587	753,775	826,932
Black plates[4]					142,403	212,698
Iron sheets				37,928	49,293	63,789
Total for United Kingdom				818,515	945,471	1,103,419

[1] Figures for Austria-Hungary, Belgium, Sweden, and the United Kingdom are taken from National Federation of Iron and Steel Manufacturers, London, Statistical Report, 1918, and for Germany from Mineral Industry during 1915, p. 395.
[2] Figures given in long tons (2,240 pounds) for United Kingdom and in metric tons (2,204.6 pounds) for Austria-Hungary, Belgium, and Germany.
[3] Includes sheets for tinning or galvanizing, and sheets embrace all plates and sheets under one-eighth inch thick.
[4] Figures for black plates are not given in the Statistical Report of the National Federation of Iron and Steel Workers, 1918, before 1917, and are incomplete for 1917. They represent black plates sold as such.

Iron and steel sheets and plates (dutiable)—Imports by countries.

FISCAL YEARS.

Imported from—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	6,371,455	$295,997	4,940,369	$262,393	3,603,574	$228,568
Germany	3,045,640	166,318	2,455,338	40,959	1,138,426	19,161
Canada	155,039	4,933	84,500	5,614	142,779	9,559
Belgium	5,324,812	66,392	294,820	4,264	308,044	4,323
Sweden	256,134	16,581	115,501	5,965	304,951	9,616
Russia in Europe	166,701	9,218	65,523	3,878	147,981	7,256
All other	29,111	11,019	159,684	4,287	4,009	449
Total	15,348,892	570,458	8,115,735	327,360	5,649,664	278,872

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	5,138,003	$357,874	5,018,126	$368,202	3,226,593	$227,118
Germany	520,269	13,258	1,100,594	40,948	857,706	9,012
Sweden	18,225	962	388,336	27,744	476,399	35,859
Canada	1,845,419	37,926	737,425	27,559	107,275	7,221
Mexico			196,585	6,112		
Belgium	681,382	10,296	433,003	5,897	1,059,404	11,999
All other	138,520	8,149	12,205	1,506	7,359	780
Total	8,341,818	428,465	7,886,274	477,968	5,734,697	291,989

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	3,035,966	$257,371	3,301,641	$412,863	2,581,085	$430,832
Sweden	413,145	20,887	259,310	19,794	1,860,985	308,856
Canada	293,408	8,282	75,154	2,984	93,259	8,043
Denmark			61,759	4,130		
Mexico	70,892	1,986	32,689	1,092	49,641	2,550
All other	14,250	709			114,600	2,965
Total	3,827,661	289,235	3,730,553	440,863	4,699,570	753,246

CALENDAR YEARS.

Imported from—	1918		1919	
	Pounds.		*Pounds.*	
Denmark			10,740	$6,528
France			484	275
Sweden	1,578,692	$298,704	550,334	66,834
United Kingdom:				
England	1,569,157	317,405	1,803,385	367,642
Scotland	3,549	1,158		
Canada	131,055	12,326	88,836	14,269
Panama	114,600	2,965		
Australia			91	11
Total	3,397,053	632,558	2,453,870	455,559

ets of iron or steel, common or black, and skelp iron or steel, not sheared or rolle grooves—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compu ad valo rate
al year:		*Pounds.*				*Per ce*
1907	$\frac{1}{10}$ to $\frac{2}{5}$ cent per pound.	1,529,727	$30,533.00	$11,086.92	$0.02	3
1908	$\frac{1}{10}$ to $1\frac{1}{10}$ cents per pound.	1,061,704	21,910.00	7,481.92	.02	2
1909	$\frac{1}{10}$ to $1\frac{1}{10}$ cents per pound.	1,030,646	21,332.00	8,321.88	.021	3
1910 [1]	$\frac{1}{10}$ to $1\frac{1}{10}$ cents per pound.	181,174	3,389.00	1,411.41	.019	4
1910 [2]	$\frac{1}{10}$ cent per pound to 30 per cent.	1,873,795	41,138.00	11,289.89	.022	2
1911	do	3,340,675	55,886.00	18,079.64	.017	3
1912	do	1,468,445	33,535.00	9,217.99	.023	2
1913	do	1,085,267	28,118.00	6,858.88	.026	2
1914 [3]	do	228,652	5,749.00	1,261.86	.025	2
1914 [4]	12 per cent	505,441	11,394.00	1,367.28	.023	1
1915	do	1,201,240	23,175.00	2,781.00	.018	1
1916	do	54,387	1,743.00	209.16	.032	1
1917	do	28,575	1,883.00	225.96	.066	1
1918	do	7,160	1,796.00	215.52	.251	1
1919	do	10,950	729.00	87.48	.067	1
ndar year:						
1918	do	6,610	1,774.00	212.88	.268	1
1919	do	20,066	1,287.00	154.44	.064	1

[1] July 1 to Aug. 5, 1909.
[2] Aug. 6, 1909, to June 30, 1910.
[3] July 1 to Oct. 3, 1913.
[4] Oct. 4, 1913, to June 30, 1914.

ets of iron or steel, common or black, and skelp iron or steel, cold rolled, smoo only, not polished—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Acti and c putec valor rat
al year:						
1907	$\frac{1}{10}$ to $1\frac{1}{10}$ cents per pound	*Pounds.* 182,266	$4,351.00	$1,793.67	$0.024	*Per c*
1908	do	270,068	13,102.00	3,238.72	.049	
1909	do	91,839	2,687.00	965.58	.029	
1910 [1]	$\frac{1}{10}$ cent per pound.	11,892	325.00	107.03	.027	
1910 [2]	$\frac{1}{10}$ cent per pound. to $\frac{1}{10}$ cent per pound + 30 per cent	369,755	9,370.00	3,126.97	.025	
1911	do	134,669	3,382.00	1,015.61	.025	
1912	$\frac{1}{10}$ cent per pound.	19,614	545.00	137.30	.028	
1913	$\frac{1}{10}$ cent per pound. to $\frac{1}{10}$ cent per pound + 30 per cent	91,031	2,749.00	918.12	.03	
1914 [3]	1 cent per pound to $\frac{1}{10}$ cent per pound + 30 per cent	7,059	357.00	121.23	.051	
1914 [4]	15 per cent	487,806	37,460.00	5,619.00	.077	
1915	do	66,819	3,431.00	514.65	.051	
1916	do	1,054	129.00	19.35	.123	
1917	do	2,415	417.00	62.55	.173	
1918	do	124,387	29,571.00	4,435.65	.238	
1919	do	146,017	62,759.00	9,413.85	.43	
ndar year:						
1918	do	210,282	71,834.00	10,775.10	.342	
1919	do	105,906	36,583.00	5,487.45	.345	

[1] July 1 to Aug. 5, 1909.
[2] Aug. 6, 1909, to June 30, 1910.
[3] July 1 to Oct. 3, 1913.
[4] Oct. 4, 1913, to June 30, 1914.

Sheets of iron or steel, polished, planished, or glanced—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1907	2 cents per pound	138,577	$8,834.00	$2,771.54	$0.064	31.37
1908	do	109,588	6,019.00	2,191.76	.055	36.41
1909	do	96,388	6,159.00	1,927.76	.064	31.30
1910[1]	do	101,303	5,649.00	2,026.06	.056	35.87
1910[2]	1½ cents per pound	13,521	965.00	202.83	.071	21.02
1911	do	85,252	5,593.00	1,278.81	.066	22.86
1912	do	151,208	7,437.00	2,268.13	.049	30.50
1913	do	8,530	431.00	127.95	.051	29.48
1914[3]	15 per cent	689,695	62,012.00	9,301.80	.09	15.00
1915	do	817,551	44,989.00	6,748.35	.06	15.00
1916	do	261,154	18,215.00	2,732.25	.07	15.00
1917	do	460	27.00	4.05	.059	15.00
1918	do	10,408	2,544.00	381.60	.244	15.00
1919	do	72,938	16,025.00	2,403.75	.22	15.00
Calendar year:						
1918	do	59,151	12,410.00	1,861.50	.21	15.00
1919	do	200,431	49,373.00	7,405.95	.25	15.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Sheets of iron or steel, corrugated or crimped—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1907	1 1/10 cents per pound	2,591	$205.00	$28.49	$0.079	13.90
1908	do	4,423	105.00	48.65	.024	46.33
1909	do	15	5.00	.17	.333	3.40
1910[1]						
1910[2]	30 per cent	4,318	188.00	56.40	.044	30.00
1911	do	4,840	194.00	58.20	.04	30.00
1912	do	2,066	87.00	26.10	.042	30.00
1913	do	470	49.00	14.70	.104	30.00
1914[3]						
1914[4]	12 per cent	398,807	4,461.00	535.32	.011	12.00
1915	do	4,700	270.00	32.40	.057	12.00
1916	do	60,800	1,676.00	201.12	.028	12.00
1917	do	100	15.00	1.80	.15	12.00
1918	do	822	29.00	3.48	.035	12.00
1919	do					
Calendar year:						
1915	do					
1919	do	513	104.00	12.48	.020	12.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Sheets and plates (except saw plates) when made by the Bessemer[1], Siemens-Martin, open-hearth, or similar process, not containing alloys such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys [2]—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1907	$\frac{1}{10}$ to $4\frac{7}{10}$ cents per pound.	2,154,623	$160,673.00	$33,639.32	$0.074	20.93
1908	....do....	2,668,528	198,940.00	41,548.40	.075	20.89
1909	$\frac{1}{10}$ to $4\frac{7}{10}$ cents per pound.	4,427,851	360,279.00	71,647.57	.081	19.89
1910[3]	$\frac{1}{10}$ to $4\frac{7}{10}$ cents per pound.	459,980	34,765.00	7,124.74	.075	20.49
1910[4]	$\frac{1}{10}$ cent per pound to 20 per cent.	8,072,542	303,960.00	63,549.17	.038	20.91
1911	....do....	3,130,645	165,346.00	34,865.34	.053	21.09
1912	$\frac{1}{10}$ cent per pound to 20 per cent.	2,289,789	152,141.00	30,285.85	.066	19.91
1913	....do....	5,351,622	278,620.00	55,005.50	.052	19.74
1914[5]	$\frac{1}{10}$ cent per pound to 20 per cent.	1,287,650	75,617.00	15,174.45	.059	20.07
1915[6]	8 per cent	2,146,798	112,687.00	9,014.96	.052	8.00
1915	....do....	1,735,447	91,157.00	7,292.56	.053	8.00
1916	....do....	2,231,279	154,197.00	12,335.76	.069	8.00
1917	....do....	2,230,511	208,078.00	16,646.24	.093	8.00
1918	....do....	3,345,681	386,735.00	30,938.80	.116	8.00
1919	....do....	830,549	104,925.00	8,394.00	.126	8.00
Calendar year:						
1918	....do....	2,269,863	271,342.00	21,707.36	.120	8.00
1919	....do....	1,248,931	142,784.00	11,422.72	.114	8.00

[1] Bessemer, etc., added by act of 1913.
[2] Saw plates are included prior to 1910.
[3] July 1 to Aug. 5, 1909, under act of 1897.
[4] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[5] July 1 to Oct. 3, 1913, under act of 1909.
[6] Oct. 4, 1913, to June 30, 1914, under act of 1913.

*Sheets and plates (except saw plates) when made by the Bessemer[1], Siemens-Martin, open-hearth, or similar process, not containing alloys, such as nickel, cobalt * * * and similar alloys, cold-hammered, blued, brightened, tempered, or polished, by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only[2]—Imports for consumption—Revenue.*

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year—		*Pounds.*				*Per cent.*
1907	$1\frac{1}{10}$ to $5\frac{7}{10}$ cents per pound.	130,227	$7,130.00	$3,246.00	$0.055	45.53
1908	$2\frac{1}{10}$ to $5\frac{7}{10}$ cents per pound.	57,793	6,670.00	1,905.40	.115	28.56
1909	....do....	73,080	18,347.00	3,611.88	.251	19.69
1910[3]	$3\frac{1}{10}$ to $5\frac{7}{10}$ cents per pound.	17,494	3,995.00	932.28	.228	23.34
1910[4]	$3\frac{1}{10}$ cents per pound to $\frac{4}{10}$ cent per pound plus 20 per cent.	47,085	11,803.00	2,786.07	.251	23.61 22.86
1911	$2\frac{1}{10}$ cents per pound to $\frac{4}{10}$ cent per pound plus 20 per cent.	70,916	18,746.00	4,285.30	.264	23.52
1912	$1\frac{9}{10}$ cents per pound to $\frac{4}{10}$ cent per pound plus 20 per cent.	69,303	15,551.00	3,657.55	.224	23.52
1913	5 cents per pound to $\frac{4}{10}$ cent per pound plus 20 per cent.	65,070	17,056.00	3,968.29	.262	23.27
1914[5]	....do....	15,464	4,263.00	983.68	.276	23.08
1914[6]	15 per cent	34,876	4,894.00	734.10	.14	15.00
1915	....do....	222,883	10,765.00	1,614.75	.048	15.00
1916	....do....	10,964	1,302.00	195.30	.119	15.00
1917	....do....	2,177	840.00	126.00	.386	15.00
1918	....do....	4,313	1,806.00	270.90	.418	15.00
1919	....do....	1,067	458.00	68.70	.429	15.00
Calendar year—						
1918	....do....	2,890	1,368.00	205.20	.473	15.00
1919	....do....	99	10.00	1.50	.102	15.00

[1] Bessemer, etc., added by act of 1913.
[2] Saw plates are included prior to 1910.
[3] July 1 to Aug. 5, 1909, under act of 1897.
[4] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[5] July 1 to Oct. 3, 1913, under act of 1909.
[6] Oct. 4, 1913, to June 30, 1914, under act of 1913.

…ts and plates (except saw plates) when made by the Bessemer,[1] Siemens-Martin, open-…earth, or similar process, not containing alloys, such as nickel, cobalt, vanadium … and similar alloys, cold-rolled, smoothed only, not polished[2]—Imports for …nsumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
…cal year—		*Pounds.*				*Per cent.*
1907	$\frac{1}{16}$ to $4\frac{1}{16}$ cents per pound.	64,946	$6,281.00	$1,547.62	$0.097	24.64
1908	$\frac{1}{16}$ to $2\frac{1}{16}$ cents per pound.	8,462	405.00	85.66	.048	21.15
1909	$\frac{1}{16}$ to $4\frac{1}{16}$ cents per pound.	2,727	1,164.00	53.08	.043	4.55
1910[3]	$1\frac{1}{16}$ to $4\frac{1}{16}$ cents per pound.	66,413	5,276.00	1,030.71	.079	19.53
1910[4]	1 to $1\frac{1}{16}$ cents per pound.	16,770	507.00	168.46	.03	33.23
1911	1 to $4\frac{1}{16}$ cents per pound.	49,973	2,311.00	686.03	.046	29.68
1912						
1913	$\frac{1}{16}$ to $2\frac{1}{16}$ cents per pound.	213,898	5,289.00	1,834.50	.025	34.69
1914[5]	1 to $2\frac{1}{16}$ cents per pound.	741	44.00	10.21	.059	23.21
1914[6]	15 per cent	374,101	37,954.00	5,693.10	.101	15.00
1915	do	75,438	3,115.00	467.25	.041	15.00
1916	do	29,155	2,236.00	335.40	.077	15.00
1917	do	2,763	593.00	88.95	.215	15.00
1918	do	199,793	120,448.00	18,067.20	.603	15.00
1919	do	30,882	13,265.00	1,989.75	.429	15.00
Calendar year—						
1918	do	209,066	124,433.00	18,664.95	.595	15.00
1919	do	42,949	18,524.00	2,778.60	.431	15.00

[1] Bessemer, etc., added by act of 1914.
[2] Saw plates are included prior to 1910.
[3] July 1 to Aug. 5, 1909, under act of 1897.
[4] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[5] July 1 to Oct. 3, 1913, under act of 1909.
[6] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Sheets and plates (except saw plates), when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1914[1]	15 per cent	172,125	$16,867.00	$2,530.09	$0.098	15
1915	do	237,974	25,421.00	3,813.15	.107	15
1916	do	571,392	68,512.00	10,276.80	.119	15
1917	do	1,250,676	204,826.00	30,723.90	.164	15
1918	do	561,876	120,886.00	18,132.90	.215	15
1919	do	572,738	151,254.00	22,688.10	.264	15
Calendar year:						
1918	do	218,066	56,639.00	8,495.85	.260	15
1919	do	531,322	136,614.00	20,492.10	.257	15

[1] Oct. 4, 1913, to June 30, 1914.

Sheets and plates, when made by the crucible, electric, or cementation process, either with or without alloys, cold-rolled, smoothed only, not polished—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
…cal year:		*Pounds.*				*Per cent.*
1916	15 per cent	148,132	$4,999.00	$749.85	$0.034	15
1917	do	32,702	3,924.00	588.60	.12	15
1918	do	4,066	2,052.00	307.80	.505	15
1919	do	90,061	26,158.00	3,923.70	.29	15
…ndar year:						
1918	do	4,353	2,186.00	327.90	.502	15
1919	do	98,405	28,253.00	4,237.95	.287	15

Sheets and plates (except saw plates), when made by the crucible, electric, or cementation process, either with or without alloys, cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1914 [1]	15 per cent	20	$4.00	$0.60	$0.20	15
1915	do	5,595	491.00	73.65	.088	15
1916	do	42,047	4,561.00	684.15	.108	15
1917	do	3,480	1,145.00	171.75	.329	15
1918	do	1,370	985.00	147.75	.719	15
1919	do	9,965	3,748.00	562.20	.376	15
Calendar year:						
1918	do	10,928	4,530.00	679.50	.415	15
1919	do	407	203.00	30.45	.499	15

[1] Oct. 4, 1913, to June 30, 1914.

Steel sheets and plates[1]—Domestic exports.

FISCAL YEARS.

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	12,112,795	$303,744	9,484,680	$233,411	18,819,009	$427,041
Germany			839,209	14,793	1,627,615	30,918
Canada	256,554,413	4,875,466	348,111,844	6,437,314	418,414,380	7,457,232
Japan	1,131,829	20,422	13,556,502	239,894	56,428,028	1,519,123
Australia	5,258,172	78,701	18,676,713	284,835	21,814,360	342,285
Cuba	5,418,342	108,490	6,375,728	131,394	9,604,646	153,883
Panama	4,117,528	87,953	2,831,976	46,547	14,968,119	300,004
Chile	2,686,029	58,940	23,196,938	604,727	41,758,486	1,044,814
Mexico	16,294,770	400,383	13,273,151	297,397	6,755,529	151,356
British India	1,149,445	27,595	422,719	8,734	3,997,150	66,624
Philippine Islands	658,197	12,798	1,922,629	34,084	2,903,584	82,163
All other	6,941,179	145,573	10,614,564	230,710	27,691,857	752,113
Total	312,322,699	6,120,065	449,306,653	8,563,840	624,782,763	12,327,561

Steel sheets—Domestic exports.

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	17,846,407	$377,203	10,267,089	$298,115	3,294,899	$88,134
Germany	1,068,342	23,248	1,240,963	39,269	73,381	2,424
Canada	240,618,018	3,916,764	195,032,365	3,014,796	132,720,489	1,922,088
Japan	2,769,577	69,464	2,343,141	67,476	798,060	19,957
Australia	1,215,613	19,190	15,219,527	451,762	8,561,801	234,723
Cuba	979,689	18,162	10,176,383	283,737	12,238,014	331,894
Panama	751,116	13,105	2,231,008	63,564	1,261,924	33,375
Chile	25,005,801	750,000	22,969,765	630,098	7,948,155	195,935
Mexico	1,952,695	49,837	6,133,014	160,788	1,617,659	44,494
Peru	2,514,795	61,662	5,995,723	158,801	602,489	14,646
British India	523,298	8,439	1,104,107	26,839	6,854,645	151,625
Philippine Islands	225,541	6,137	6,340,117	186,498	907,337	25,610
Argentina	106,620	2,886	21,316,476	545,877	13,716,090	343,412
All other	2,162,925	52,860	28,887,843	841,617	24,593,602	609,648
Total	297,740,437	5,368,957	328,957,521	6,769,237	215,188,535	4,017,965

[1] Steel sheets listed separately after 1912.

Steel sheets—Domestic exports—Continued.

FISCAL YEARS—Continued.

Exported to—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	20,399,867	$423,322	19,738,670	$585,131	3,265,995	$134,415
Canada	158,413,175	3,113,493	167,021,089	5,713,295	186,496,477	9,953,517
France	6,058,103	139,141	3,605,420	122,500	10,399,798	646,778
Italy	2,816,190	69,230	3,914,451	157,960	4,614,211	318,430
Cuba	2,532,026	79,040	2,278,249	91,623	2,790,693	248,802
Panama	250,700	5,354	251,532	10,337	297,956	22,270
Argentina	2,409,957	60,829	3,272,689	125,159	4,800,237	385,223
Brazil	2,354,689	86,006	2,988,762	144,600	4,459,661	388,629
Chile	5,151,783	136,907	3,997,310	167,623	5,980,260	439,251
Mexico	401,885	11,634	736,866	38,742	808,015	70,498
Japan	8,139,716	212,013	44,651,743	1,893,600	115,276,790	10,045,768
Australia	1,818,192	41,021	4,738,541	170,056	9,731,861	771,737
British India	87,960	1,889	5,276,670	224,583	5,413,577	338,679
Philippine Islands	11,990	234	1,223,031	61,018	2,334,881	211,773
All other	9,362,473	260,569	22,021,438	975,871	39,285,899	3,103,159
Total	220,208,716	4,640,682	285,806,461	10,482,008	396,016,311	27,078,929

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
Canada	139,723,978	$7,302,032	119,890,134	$4,906,290
Japan	120,642,862	10,865,363	85,385,782	5,142,462
France	20,611,095	1,158,246	45,611,071	2,310,069
All other	85,084,688	6,321,108	146,638,207	8,855,708
Total	366,062,623	25,646,749	397,525,194	21,214,529

Iron sheets and plates—Domestic exports.[1]

FISCAL YEARS.

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	1,696,265	$41,630	126,973	$3,774	125,013	$3,380
Canada	50,580,262	1,264,985	47,788,428	1,139,918	87,581,228	2,030,643
Argentina	35,987,635	906,851	39,978,998	993,238	72,199,061	1,778,283
Mexico	19,870,800	603,595	18,185,609	580,107	20,207,209	608,372
Cuba	13,248,174	345,306	16,968,697	450,974	15,610,457	419,748
Brazil	1,211,423	32,489	2,453,249	78,076	10,037,788	317,776
Chile	9,302,812	233,152	3,636,185	100,923	9,997,443	259,951
Peru	2,103,399	56,301	2,495,788	68,117	2,761,296	74,466
British India	6,848,500	169,888	7,021,066	178,334	40,494,003	1,009,938
Japan	12,330,560	419,720	21,466,402	737,414	44,498,533	1,475,609
Australia and Tasmania	19,824,265	559,062	17,335,207	520,824	18,454,601	544,589
Philippine Islands	14,143,435	467,909	19,700,352	676,388	25,351,158	853,602
Other	1,009,607	31,825	5,528,636	167,000	5,882,060	185,064
All other	26,035,367	727,813	29,866,639	849,938	64,268,129	1,779,403
Total	214,192,504	5,860,526	232,552,239	6,545,585	417,527,979	11,320,829

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	766,497	$15,617	190,448	$4,555	796,353	$15,234
Canada	31,136,170	692,434	19,526,400	434,525	12,338,179	280,524
Argentina	15,545,442	393,676	2,447,767	59,869	3,316,061	84,028
Mexico	3,010,130	77,823	887,627	27,251	424,927	15,301
Cuba	1,812,015	34,629	452,268	12,275	653,806	15,761
Brazil	2,189,556	60,603	904,562	25,741	1,186,898	34,893
Chile	350,344	8,427	221,005	5,537	677,802	10,613
Honduras	24,620	611	152,155	4,151	233,823	5,849
Japan	7,346,406	226,121	145,501	4,768	489,963	11,344
Panama	722,669	16,184	97,001	2,248	152,361	3,057
British India	2,549,171	53,106	66,636	1,519	81,005	1,718
All other	5,084,804	141,223	614,399	18,052	986,580	26,923
Total	71,737,824	1,721,454	25,706,775	600,491	21,337,758	505,145

[1] Includes "Galvanized" prior to 1913.

Iron sheets and plates—Domestic exports—Continued.

FISCAL YEARS—Continued.

Exported to—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	8,036,665	$166,598	5,720,962	$195,337	1,461,096	397,397
Canada	36,436,399	888,303	46,995,442	1,789,700	57,787,247	3,185,674
France	5,118,134	109,170	3,067,308	141,334	3,907,421	252,351
Argentina	15,880,575	341,966	11,165,536	340,600	8,804,356	613,035
Japan	6,474,496	143,942	8,887,223	360,804	17,465,171	1,441,504
Australia	2,998,434	58,318	924,822	35,643	3,008,754	223,054
Mexico	1,142,217	39,166	1,366,215	76,653	1,155,540	87,271
Cuba	2,199,911	68,404	4,844,315	197,929	1,523,677	113,717
Brazil	2,395,382	65,972	6,597,694	290,798	2,378,291	179,782
Chile	2,401,623	61,839	1,119,389	42,728	2,544,051	188,869
China	2,258,412	79,694	757,018	31,731	2,107,971	173,308
Panama	522,156	11,808	194,596	7,755	151,175	15,192
Philippine Islands	162,551	5,062	226,522	14,041	1,124,927	90,167
British India	44,975	814	10,701,690	400,481	1,465,694	88,391
All other	9,419,435	219,687	15,223,882	655,499	18,519,419	1,499,397
Total	95,491,365	2,260,743	117,792,614	4,581,033	123,404,790	8,249,169

CALENDAR YEARS

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
United Kingdom	2,673,054	$130,226	1,794,657	$60,489
Canada	39,953,614	2,049,748	23,896,744	1,112,009
France	7,364,155	371,372	15,294,211	702,935
Argentina	2,508,625	189,674	1,829,336	101,397
Japan	14,465,504	1,621,639	21,636,977	1,237,491
Australia	5,738,361	414,538	5,007,683	354,434
Mexico	704,067	44,891	1,662,924	108,118
Cuba	1,004,738	79,631	1,326,785	83,710
Brazil	1,035,397	78,769	4,468,754	301,301
Chile	769,246	60,891	1,337,473	90,871
China	1,199,291	113,314	1,371,665	96,622
Panama	18,562	1,423	87,381	5,055
Philippine Islands	1,266,715	98,972	1,870,268	108,694
British India	453,331	37,774	1,171,177	72,908
All other	12,138,732	1,022,233	6,612,250	401,513
Total	91,293,392	6,315,095	89,358,285	4,837,547

No. 28 black sheets—Prices, wholesale, at Pittsburgh, in cents per pound.

[From The Iron Age.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
January	2.40	2.20	1.90	2.31	1.87	1.80	2.60	4.50	5.00	4.70	4.48
February	2.40	2.20	1.87	2.35	1.95	1.80	2.60	4.69	5.00	4.70	5.00
March	2.40	2.20	1.80	2.35	1.95	1.80	2.71	4.94	5.00	4.61	5.50
April	2.40	2.20	1.86	2.35	1.91	1.80	2.85	5.75	5.00	4.35	5.50
May	2.40	2.20	1.90	2.30	1.85	1.79	2.89	7.00	5.00	4.35	5.50
June	2.40	2.00	1.90	2.27	1.81	1.75	2.90	7.88	5.00	4.35	5.50
July	2.23½	2.00	1.95	2.25	1.80	1.75	2.90	8.50	5.00	4.35	6.75
August	2.21	1.99	2.02	2.21	1.86	1.85	2.90	8.50	5.00	4.35	7.50
September	2.15	1.91	2.07	2.14	1.95	1.90	2.93	8.50	5.00	4.35	7.38
October	2.20	1.85	2.21	2.04	1.94	2.03	3.23	.....	5.05	4.35	6.60
November	2.20	1.85	2.25	1.97	1.87	2.25	3.65	5.00	5.00	4.35	5.77
December	2.19	1.83¾	2.25	1.89	1.82	2.59	4.31	5.00	4.85	4.35	4.35
Average	2.39	2.04	2.00	2.20	1.88	1.92	3.04	5.86	4.99	4.43	5.83
Highest	2.40	2.20	2.25	2.35	1.95	2.50	4.31	8.50	5.05	4.70	7.50
Monthly average: Lowest	2.15	1.83¾	1.80	1.89	1.80	1.75	2.60	4.50	4.85	4.35	4.35

No. 24-gauge black sheets—Prices per gross ton, England and Wales.

[From The Iron and Coal Trades Review.]

	1918			1919				1920			
	£	s.	d.	£	s.	d.		£	s.	d.	
January				18	10	0	$90.05	32	0	0	$155.73
February					(1)			38	0	0	184.93
March				20	10	0	99.78	42	0	0	204.39
April				20	10	0	99.78	42	0	0	204.39
May				21	10	0	104.65				
June	18	0	0	$87.60	22	10	0	109.51			
July	18	0	0	87.60	22	10	0	109.51			
August	18	0	0	87.60	23	14	0	115.36			
September	18	0	0	87.60	24	8	9	118.94			
October	18	5	0	88.83	26	17	0	130.70			
November	18	10	0	90.05	29	0	0	141.13			
December	18	10	0	90.05	29	0	0	141.13			
Average					23	10	10	114.58			
Highest					29	0	0	141.13			
Monthly average: Lowest					18	10	0	90.05			

[1] No price stated

Court and Treasury Decisions.

A thin plate of iron or steel, common or black, three-eighths of an inch thick, on which a thin sheet of nickel or copper of the same dimensions have been laid and then subjected to a process of heat rolling to weld the materials together, was held not dutiable as a sheet of iron or steel, and since in thickness it exceeded No. 10 wire gauge it was not dutiable under either paragraph 126 or paragraph 131 of the act of 1897, but under paragraph 193 as a manufacture of metal. Paragraphs 126 and 131 were declared to provide in effect that such a piece of iron or steel should be held to be a sheet thinner than No. 10 wire gauge, but if not thinner than No. 10 wire gauge it should be held to be a plate. (Boker *v.* United States, 2 Ct. Cust. Appls., 162.) Like classification was made of corrugated-iron sheets galvanized. (Moore *v.* United States, 1 Ct. Cust. Appls., 115.)

Sheet steel made by the open-hearth process, containing 0.55 per cent manganese and 0.2 per cent silicon, added in the course of manufacture, is dutiable at the 8 per cent under paragraph 110 of the act of 1913. Being essential to the production of Bessemer and open-hearth steel, manganese and silicon can not be considered alloys without rendering ineffective the entire provision for such steel. (G. A. 7708, T. D. 35297 of 1915.) (See Survey of the Plates.)

Iron and steel sheets—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	151	* * * sheet iron, common or black:	
		Thinner than 1½ inches and not thinner than No. 20 wire gauge	1 1/10 cents per pound.
		Thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge.	1 3/10 cents per pound.
		Thinner than No. 25 wire gauge and not thinner than No. 29 wire gauge.	1 4/10 cents per pound.
		Thinner than No. 29 wire gauge	30 per cent ad valorem.
1883	152	Polished, planished, or glanced sheet iron, or sheet steel, by whatever name designated.	2½ cents per pound.
1883	153	* * * corrugated or crimped sheet iron or steel	1 6/10 cents per pound.

Iron and steel sheets—Rates of duty—Continued.

	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
	177	* * * sheets of all gauges and widths; * * * pressed, sheared, or stamped shapes, or blanks of sheet or plate steel, or combination of steel and iron, punched or not punched; * * * all of the above classes of steel not otherwise specially provided for in this act:	
		Valued at 4 cents a pound or less	45 per cent ad valorem.
		Valued above 4 cents a pound and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2½ cents per pound.
		Valued at above 10 cents per pound	3½ cents per pound.
		Provided, That on all * * * steel sheets, of whatever shape, * * * cold-rolled, cold-hammered, or polished in any way in addition to the ordinary process of hot-rolling or hammering, there shall be paid one-fourth cent per pound, in addition to the rates provided in this act.	
90	142	Sheets of iron or steel, common or black, * * * and skelp iron or steel, valued at 3 cents per pound or less:	
		Thinner than No. 10 and not thinner than No. 20 wire gauge	1 cent per pound.
		Thinner than No. 20 wire gauge, and not thinner than No. 25 wire gauge	1 1/10 cents per pound.
		Thinner than No. 25 wire gauge	1 1/10 cents per pound.
		Corrugated or crimped	Do.
		Provided, That all common or black sheet iron or sheet steel not thinner than No. 10 wire gauge shall pay duty as plate iron or plate steel.	
90	144	Sheet iron or sheet steel, polished, planished, or glanced, by whatever name designated.	2½ cents per pound.
	146	* * * sheets * * * not specially provided for in this act; all of the above:	
		Valued at 1 cent per pound or less	7/10 cent per pound.
		Valued above 1 cent and not above 1 7/10 cents per pound	7/10 cent per pound.
		Valued above 1 7/10 cents and not above 1 7/10 cents per pound	7/10 cent per pound.
		Valued above 1 7/10 and not above 2 1/10 cents per pound	7/10 cent per pound.
		Valued above 2 1/10 cents and not above 3 cents per pound	1 1/10 cents per pound.
		Valued above 3 cents and not above 4 cents per pound	1 1/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 1/10 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	3½ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	4 1/10 cents per pound.
		Valued above 16 cents per pound	7 cents per pound.
	152	* * * on all sheets of iron or steel of whatever shape, other than the polished, planished, or glanced sheet iron or sheet steel hereinbefore provided for, which are cold rolled, cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish, or polish better than the grade of cold rolled, smooth only, hereinbefore provided for, there shall be paid 1½ cents per pound in addition to the rates provided in this act upon * * * sheets of iron or steel of common or black finish.	
94	118	Sheets of iron or steel, common or black, * * * and skelp iron or steel, valued at 3 cents per pound or less—	
		Thinner than No. 10 and not thinner than No. 20 wire gauge	7/10 cents per pound.
		Thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge.	1 1/10 cents per pound.
		Thinner than No. 25 wire gauge	1 1/10 cents per pound.
		Corrugated or crimped	Do.
		Provided, That all common or black sheet iron or sheet steel not thinner than No. 10 wire gauge shall pay duty as plate iron or plate steel.	
	120	Sheet iron or sheet steel, polished, planished, or glanced, by whatever name designated.	1½ cents per pound.
	122	* * * sheets, not specially provided for in this act: * * * all of the above—	
		Valued at 1 cents per pound or less	7/10 cent per pound.
		Valued above 1 cent and not above 1 7/10 cents per pound	7/10 cent per pound.
		Valued above 1 7/10 cents and not above 1 7/10 cents per pound	7/10 cent per pound.
		Valued above 1 7/10 cents and not above 2 1/10 cents per pound	7/10 cent per pound.
		Valued above 2 1/10 cents and not above 3 cents per pound	7/10 cent per pound.
		Valued above 3 cents and not above 4 cents per pound	1 1/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	1 1/10 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	1 1/10 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	2 1/10 cents per pound.
		Valued above 13 cents and not above 16 cents per pound	2 1/10 cents per pound.
		Valued above 16 cents per pound	4 1/10 cents per pound.
97	131	Sheets of iron or steel, common or black, of whatever dimensions and skelp iron or steel, valued at 3 cents per pound or less—	
		Thinner than No. 10 and not thinner than No. 20 wire gauge	7/10 cent per pound.
		Thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge.	7/10 cent per pound.
		Thinner than No. 25 wire gauge and not thinner than No. 32 wire gauge.	1 1/10 cents per pound.
		Thinner than No. 32 wire gauge	1 1/10 cents per pound.
		Corrugated or crimped	1 1/10 cents per pound.
		Provided, That all sheets of common or black iron or steel not thinner than No. 10 wire gauge shall pay duty as plate iron or plate steel.	

Iron and steel sheets—Rates of duty—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1897	133	Sheets of iron or steel, polished, planished, or glanced, by whatever name designated.	2 cents per pound.
	135	* * * sheets * * * and steel in all forms and shapes not specially provided for in this act; all of the above—	
		Valued at 1 per cent pound or less	$\frac{1}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $1\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{2}{10}$ cents and not above $2\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $2\frac{2}{10}$ cents and not above 3 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 16 cents per pound	$4\frac{1}{10}$ cents per pound.
	141	* * * on all sheets of iron or steel of whatever shape, other than the polished, planished, or glanced sheet iron or sheet steel hereinbefore provided for, which are cold rolled, cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, hereinbefore provided for, there shall be paid 1 cent per pound in addition to the rates provided in this act upon sheets of iron or steel of common or black finish.	
1909	127	Sheets of iron or steel, common or black, of whatever dimensions, and skelp iron or steel, valued at 3 cents per pound or less—	
		Thinner than No. 10 and not thinner than No. 20 wire gauge	$\frac{1}{10}$ cent per pound.
		Thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge.	$\frac{1}{10}$ cent per pound.
		Thinner than No. 25 wire gauge and not thinner than No. 32 wire gauge.	$\frac{1}{10}$ cent per pound.
		Thinner than No. 32 wire gauge	$\frac{1}{10}$ cent per pound.
		Corrugated or crimped	$\frac{1}{10}$ cent per pound.
		All the foregoing valued at more than 3 cents per pound	30 per cent ad valorem.
		Provided, That all sheets or plates of common or black iron or steel not thinner than No. 10 wire gauge shall pay duty as plate iron or plate steel.	
	129	Sheets of iron or steel, polished, planished, or glanced, by whatever name designated.	$1\frac{1}{2}$ cents per pound.
	131	* * * sheets * * * and steel not specially provided for in this section; all of the above—	
		Valued at three-fourths of 1 cent per pound or less	$\frac{1}{10}$ cent per pound.
		Valued above three-fourths of 1 cent and not above $1\frac{1}{10}$ cents per pound.	$\frac{1}{10}$ cent per pound.
		Valued above $\frac{1}{10}$ cents and not above $1\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $2\frac{1}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above $2\frac{1}{10}$ cents and not above 3 cents per pound	$\frac{1}{10}$ cent per pound.
		Valued above 3 cents and not above 4 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	$1\frac{1}{10}$ cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{1}{10}$ cents per pound.
		Valued above 16 cents and not above 24 cents per pound	$4\frac{1}{10}$ cents per pound.
		Valued above 24 cents and not above 32 cents per pound	6 cents per pound.
		Valued above 32 cents and not above 40 cents per pound	7 cents per pound.
		Valued above 40 cents per pound	20 per cent ad valorem.
	137	* * * on all sheets of iron or steel of whatever shape, other than polished, planished, or glanced sheet iron or sheet steel hereinbefore provided for, which are cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, hereinbefore provided for, there shall be paid four-tenths of 1 cent per pound in addition to the rates provided in this section upon * * * sheets of iron or steel of common or black finish of corresponding gauge or value.	
1913	109	* * * sheets * * * of iron or steel, polished, planished, or glanced, by whatever name designated, * * * or which are cold rolled, smoothed only, not polished, and such as are cold hammered, blued, brightened, tempered or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only.	15 per cent ad valorem.
	110	* * * sheets, * * * all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, * * * and similar alloys.	8 per cent ad valorem.
		* * * sheets, * * * and steel not specially provided for in this section, all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.	15 per cent ad valorem.

MISCELLANEOUS.

WIRE GAUGES.

The thickness of sheets and plates is measured in wire gauges. No. 12 wire gauge is usually taken as the dividing line between plates and sheets, although No. 10 is sometimes used, and in tariffs before the present (1913) law, was the adopted one by the United States Government. For ordinary black sheets and for galvanized sheets No. 28 wire gauge is standard. Blue annealed sheets, which are heavier, have usually No. 10 as a base. The wire gauges used are given below:

No. of gauge.	United States standard for sheets and plates.	Approximate thickness (fractions of inch).	Weight per square foot.	No. of gauge.	United States standard for sheets and plates.	Approximate thickness (fractions of inch).	Weight per square foot.
			Pound.				*Pound.*
1	0.28125	9/32	11.25	20	0.0375	1/26	1.50
2	.265625	17/64	10.625	21	.034375	1/29	1.375
3	.25	1/4	10.0	22	.03125	1/32	1.25
4	.234375	15/64	9.375	23	.028125	9/320	1.125
5	.21875	7/32	8.75	24	.025	1/40	1.0
6	.203125	13/64	8.125	25	.021875	7/320	.875
7	.1875	3/16	7.5	26	.01875	3/160	.75
8	.171875	11/64	6.875	27	.0171875	11/640	.6875
9	.15625	5/32	6.25	28	.015625	1/64	.625
10	.140625	9/64	5.625	29	.0140625	9/640	.5625
11	.125	1/8	5.0	30	.0125	1/80	.5
12	.109375	7/64	4.375	31	.0109375	7/640	.4375
13	.09375	3/32	3.75	32	.01015625	13/1280	.40625
14	.078125	5/64	3.125	33	.009375	3/320	.375
15	.0703125	9/128	2.8125	34	.00859375	11/1280	.34375
16	.0625	1/16	2.5	35	.0078125	1/128	.3125
17	.05625	9/160	2.25	36	.00703125	9/1280	.28125
18	.05	1/20	2.0	37	.00640625	41/6400	.265625
19	.04375	7/160	1.75	38	.00625	1/160	.25

COST OF PRODUCTION.

The Bureau of Corporations in its investigations of the iron and steel industry compiled figures for the average cost of black sheets in the United States for the years 1902 to 1906, inclusive. These figures were itemized and averaged for the five-year period as follows:[1]

Average book cost of black sheets for years 1902–1906.

[In dollars per net ton.]

Items.	Total and average, 5 years.
Amount produced (net tons)	2,418,214
Sheet bars	$22.99
Labor	10.20
Fuel	.53
Steam	1.08
Rolls	.44
Materials in repairs and maintenance	.40
Supplies and tools	.34
Miscellaneous and general works expense	1.31
Mill cost	37.50
Additional cost:	
General and miscellaneous expense	1.17
Depreciation	.70
Total book cost	39.37

[1] *Report of Commissioner of Corporations on The Steel Industry, Part III, p. 251.*

In the above tabulation the cost of raw material (sheet bars) was about 58 per cent of the total expense and labor about 26 per cent. The book cost of converting the sheet bars into black sheets amounted to $16.38 per gross ton. The direct labor cost, therefore, of transforming the sheet bars into black sheets, amounting to $10.39, was about 63 per cent of the total conversion cost.

The figures of the Commissioner of Corporations fairly represent prewar costs. During the war prices and costs advanced very materially. Labor cost still remains a large percentage of the total expense of manufacture. The wage rates per long ton paid in 1919 to the various men for different orders when the actual average selling price of 26, 27, and 28 gauge plain steel, f. o. b. mill is $2.15 per 100 pounds, are shown in the following tabulation:[1]

Gauge.	Roller.	Heater.	Heater's helper.	Shearman.	Pair heater.	Rougher.	Catcher.	Matcher.	Doubler.	Total.
8- & 9-.....	$0.903	$0.435	$0.306	$0.412	$0.311	$0.350	$0.385	$0.300	$0.283	$3.685
9-11.....	1.003	.482	.340	.459	.347	.390	.429	.333	.315	4.098
12-14.....	1.296	.579	.409	.553	.416	.468	.515	.400	.377	4.923
15-17.....	1.426	.669	.473	.637	.458	.523	.575	.448	.422	5.631
18-20.....	1.774	.813	.575	.774	.557	.615	.677	.528	.497	6.810
21-22.....	2.001	.915	.646	.871	.626	.692	.761	.595	.560	7.667
23-24.....	2.519	1.061	.749	1.010	.726	.802	.882	.690	.649	8.888
25-26.....	2.664	1.220	.862	1.162	.835	.923	1.015	.794	.746	10.221
27.....	2.895	1.326	.936	1.263	.908	1.003	1.103	.862	.811	11.107
28.....	3.081	1.411	.997	1.343	.966	1.068	1.175	.919	.862	11.822
29.....	3.230	1.483	1.048	1.412	1.014	1.122	1.234	.965	.906	12.420
30.....	3.472	1.590	1.124	1.515	1.089	1.204	1.324	1.034	.972	13.324
31.....	4.501	2.061	1.455	1.963	1.410	1.559	1.715	1.341	1.261	17.266
32.....	5.478	2.507	1.772	2.381	1.716	1.897	2.087	1.630	1.533	21.001

As the prices of Nos. 26, 27, and 28 gauges plain sheet steel, f. o. b. mill, were much above the $2.15 per 100 pounds standard in 1919, the above figures would be materially raised to represent the labor cost in 1919. According to agreement between manufacturer and officials of the Amalgamated Association of Iron, Steel, and Tin Workers, the wage rates were advanced 1½ per cent for each member of the crew with each 5 cents per 100 pounds in price above the $2.15 base, and were reduced 1½ per cent with each decrease of 5 cents below the base price until the selling value of $1.80 per 100 pounds was reached. The increased wage rates due to rising prices kept the labor cost under this arrangement at nearly the same percentage of the total expenses as at the base price of $2.15 per 100 pounds. As prices rose the margin between labor cost and market quotations increased slightly.

At the base price of $2.15 per 100 pounds the labor cost was approximately one-fourth the selling value. Sheet bars are generally quoted at a price approximately half that of common black sheets, No. 28 grade. The labor cost for manufacturing common black sheets is not far from one-half the margin between the price of sheet bars and the price of common black sheets.

[1] Figures taken from The Iron and Coal Trades Review (London), July 2, 1920, p. 4.

Production of iron and steel plates and sheets (including black plates for tinning) by the United States Steel Corporation and Independents, years 1916–1919.[1]

Year.	Production United States Steel Corporation.	Production all other companies.	Total production.	Percentage United States Steel Corporation.
	Gross tons.	*Gross tons.*	*Gross tons.*	
1916	3,509,199	3,944,781	7,453,980	47.08
1917	3,555,296	4,712,320	8,267,616	43.00
1918	3,808,964	4,990,171	8,799,135	43.29
1919	3,266,174	4,106,640	7,372,814	44.30

[1] Annual Statistical Reports of the American Iron and Steel Institute.

Foreign tariffs.[1]

FRANCE.

Tariff No.	Description of product.	Duties.[2] General tariff.	Duties.[2] Minimum tariff.
210	Flat sheets and plate, iron or steel:		
	Not cut and of a thickness of—	*Fr. c.*	*Fr. c.*
	More than 1 millimeter, per 100 kilos (N.)	10 50	7 00
	In American currency, per 100 pounds	$0.92	$0.61
	$\frac{4}{10}$ millimeter up to 1 millimeter, per 100 kilos (N.)	13 50	9 00
	In American currency, per 100 pounds	$1.14	$0.79
	$\frac{4}{10}$ millimeter up to $\frac{4}{100}$ millimeter, per 100 kilos (N.)	15 00	10 00
	In American currency, per 100 pounds	$1.31	$0.88
	Less than $\frac{4}{10}$ millimeter, per 100 kilos (N.)	16 50	11 00
	In American currency, per 100 pounds	$1.41	$0.96
	Cut and of a thickness of—		
	More than 1 millimeter, per 100 kilos (N.)	11 25	7 50
	In American currency, per 100 pounds	$0.97	$0.62
	$\frac{4}{10}$ millimeter up to 1 millimeter, per 100 kilos (N.)	15 00	10 00
	In American currency, per 100 pounds	$1.31	$0.88
	$\frac{4}{10}$ millimeter up to $\frac{4}{100}$ millimeter, per 100 kilos (N.)	16 50	11 00
	In American currency, per 100 pounds	$1.41	$0.96
	Less than $\frac{4}{10}$ millimeter, per 100 kilos (N.)	18 00	12 00
	In American currency, per 100 pounds	$1.58	$1.05
	Flat sheet and plate, iron and steel, burnished (lustrees), cut or not, of a thickness of—		
	More than 1 millimeter, per 100 kilos (N.)	13 00	9 00
	In American currency, per 100 pounds	$1.14	$0.79
	$\frac{4}{10}$ millimeter up to 1 millimeter, per 100 kilos (N.)	17 00	11 00
	In American currency, per 100 pounds	$1.49	$0.96
	$\frac{4}{10}$ millimeter up to $\frac{4}{100}$ millimeter, per 100 kilos (N.)	18 00	12 00
	In American currency, per 100 pounds	$1.58	$1.05
	Less than $\frac{4}{10}$ millimeter, per 100 kilos (N.)	20 00	13 00
	In American currency, per 100 pounds	$1.75	$1.14
	Flat sheet and plate, iron or steel, cold rolled, fire whitened or blued, cut or not, of a thickness of—		
	More than 1 millimeter, per 100 kilos (N.)	20 00	14 00
	In American currency, per 100 pounds	$1.75	$1.23
	$\frac{4}{10}$ millimeter up to 1 millimeter, per 100 kilos (N.)	23 00	15 00
	In American currency, per 100 pounds	$2.01	$1.31
	$\frac{4}{10}$ millimeter up to $\frac{4}{100}$ millimeter, per 100 kilos (N.)	24 00	16 00
	In American currency, per 100 pounds	$2.10	$1.40
	Less than $\frac{4}{10}$ millimeter, per 100 kilos (N.)	26 00	17 00
	In American currency, per 100 pounds	$2.28	$1.49

[1] In computing the American equivalent of foreign rates of duty the normal rate of exchange is assumed.
[2] Additional taxes and 4 per cent included.

Foreign Tariffs—Continued.

GERMANY.

Tariff No.	Description of product.	Duties—General tariff.
	Sheets and plates:	
786	Rough, scaled, straightened, dressed, or varnished—	
	More than 1 millimeter in thickness	3 marks.
	In American currency, per 100 pounds	$0.32.
	1 millimeter or less	4.50 marks.
	In American currency, per 100 pounds	$0.49.
	NOTE.—Dressed sheets, to which a smooth, shining, and more or less glittering surface has been imparted by means of rolling, but which have not undergone any further process of working up, are dutiable under this number. (Treaty with Austria-Hungary.)	
787	Ground, polished, lacquered, browned, or artificially oxidized, covered or not with a shiny coating of oxide—	
	More than 1 millimeter in thickness	5 marks.
	In American currency, per 100 pounds	$0.54.
	1 millimeter or less	5.50 marks.
	In American currency, per 100 pounds	$0.59.

CANADA.

Tariff No.	Description of product.	Duties.		
		British preferential tariff.	Intermediate tariff.	General tariff.
382	Rolled iron or steel sheets or plates, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves, n. o. p.	$4.25 per ton.	$6 per ton and 7½ per cent.	$7 per ton and 7½ per cent.
384	Rolled iron or steel sheets and strips, polished or not, No. 14 gauge and thinner, n. o. p.; Canada plates; * * *.	Free.....	7½ per cent..	7½ per cent.
384-a	Rolled iron or steel hoop, scroll or strip, No. 14 gauge and thinner, and rolled iron or steel sheet, when imported by manufacturers for use in their own factories in the manufacture of galvanized iron or steel hoop, band, scroll, strip, or sheet.	.....do.....	Free.....	Free.

ADVANCED IRON AND STEEL SHEETS, ADVANCED BEYOND STAGE OF HOT ROLLING.

SUMMARY.

Iron and steel sheets are treated generally in the main survey. Sheets advanced beyond the stage of hot rolling are given a more detailed treatment in this supplementary survey.

Sheets coming under the designation of advanced may be classified according to the kind of steel used in their manufacture, the plain or grooved or corrugated character of the product, and the stage of production or finish. With reference to the first classification, iron and steel sheets may be divided into four classes: First, those made of Bessemer or open-hearth steel; second, those made of crucible and electric-furnace steel (also including such steel as is manufactured by the cementation process); third, sheets made of alloy steel; and fourth, iron sheets. The first constitute the bulk of the sheets manufactured in the United States and are the cheapest in cost, assuming the same gauge and grade of production. The second and third are more expensive, and for certain purposes are more useful. Sheets made of alloy steels vary greatly in value, depending upon the kind of alloy used. Iron sheets are now produced in this country in very limited amounts.

The second classification differentiates flat sheets and those that are grooved or crimped. The latter, while generally hot rolled as such, constitute a more advanced and costly product than the plain or flat sheets. These products are often subjected to various finishing processes which add to their value.

The third classification representing the stage of production beyond that of hot rolling shows the following important divisions:

(1) Blue annealed sheets.
(2) Box annealed sheets.
(3) Cold-worked sheets (including cold-rolled, cold-hammered, and cold-drawn sheets).
(4) Pickled sheets (or those cleaned with acid).
(5) Sheets finished beyond the stage of cold rolling and smoothing only.
(6) Russian sheet iron.

In the third classification the stages numbered 2, 3, and 4 and 2, 3, and 5 are successive stages beyond hot rolling. Blue-annealed sheets are generally sold and used as such or are cleaned and galvanized. Russian sheet iron is a special kind of sheet which for a long time was made in Russia by a secret process.

There are no published statistics regarding the country's output of iron and steel sheets advanced beyond the stage of hot rolling. The country's production of iron and steel sheets of all kinds in 1919 amounted to 3,481,493 gross tons. A considerable percentage of this output went through advanced processes.

Imported sheets constitute a small fraction of 1 per cent of the mestic consumption. In 1919 the importation of sheets and ates made of crucible or electric-furnace steel or of steel contain- g alloys was larger in proportion to probable domestic output an the importation of the other kinds of sheets separately published the reports of the Bureau of Foreign and Domestic Commerce. owever, under the assumption that the same proportion of crucible, ectric-furnace, and alloy steel ingots was rolled into sheets as in e case of Bessemer and open-hearth steel ingots, the ratio of nportation to domestic output would be only about one-tenth of per cent.

Exports, on the other hand, were much larger, those of steel sheets, mounting in 1919 to about 5 per cent of the entire domestic output. The Bureau of Foreign and Domestic Commerce does not publish he exports of sheets by stages of production or the kinds of steel sed in their manufacture. Export figures, however, are published or tin and terne plate and galvanized sheets, and these show that the exports of advanced sheets far exceed importations.

There is no present tariff problem with reference to the manufacture of iron and steel sheets advanced beyond the stage of hot-rolling or made of high-grade steel. Labor cost is an appreciable item in the total expense of production, but hot-rolling, annealing, pickling, cold-rolling, and to a large extent polishing and other finishing processes are machine operations. These processes are as cheap in the United States as in other countries, the higher wages paid in this country being offset by the larger scale of operation and greater output per man as well as by better organization. There is, however, the possibility of improved organization of the sheet-steel manufacturing industries in England in the near future, and this development, with the lower wages paid abroad, may change the competitive position of the American producer.

There is need for a better classification of iron and steel sheets in our tariff laws, especially if specific rates of duties should again be placed upon these products. The classification indicated at the beginning of this summary shows the lines along which the division among these sheets should be made. A proper division is not only necessary on account of the varying values of these products but also because of possible changes in the competitive situation of their manufacture at the different stages of production.

General Information.

DESCRIPTION.

Iron and steel sheets are treated in the main survey, of which this discussion is supplementary. Sheets coated with tin or terne or with zinc or spelter are treated in separate surveys (see "Tin and terne plate" and "Galvanized sheets"). Stamped and enameled sheets are also separately treated.

Statistics regarding output and trade are for the most part published in terms of the common hot-rolled product. As a large part of the sheets used in this country are subjected to treatment, additional to that of ordinary hot-rolling, some further discussion of the advanced stages of production is advisable.

While sheets may be defined as wide thin pieces of metal thinner than No. 12 wire gauge—(i. e., thinner than seven sixty-fourth inch thick)—pieces of metal thicker than this gauge are often included under the designation of sheets, although technically speaking such material constitutes plates. Thus blue-annealed sheets generally vary in thickness from No. 9 to No. 16 wire gauge, the prices of Nos. 9 and 10 grades being those most usually quoted.

Sheets in a more advanced stage of production than the ordinary plain hot-rolled product are generally characterized by a smoother, more polished, or otherwise improved surface and often by a finer or softer texture. Some sheets in the hot-rolling process are grooved and are thus differentiated from the common flat sheets.

The bulk of the sheets produced are manufactured from steel made in open-hearth and Bessemer furnaces. Sheets produced from crucible or electric-furnace steel are more costly than those made from Bessemer or open-hearth steel and regarded as superior to them for certain purposes. Sheets are also manufactured from alloy steels which impart certain desirable or necessary properties. Sheets used for electric transformers, for example, are made of steel containing 4 to 6 per cent silicon.

DOMESTIC PRODUCTION.

A vast variety of articles are now manufactured which require sheets which have been specially treated to suit varied needs. The uses of such sheets for automobiles, typewriters, ceilings, roofings, doors, and electric transformers are some indication of the extent and varied nature of the demand for sheets which have been specially treated or prepared.

RAW MATERIALS.

Hot-rolled sheets, or metal when hot which has been reduced by rolling to the desired thickness, constitute the raw material for the advanced grades of sheet steel. Manufactures of the hot-rolled material, however, often carry on the productive process to more advanced stages, getting their raw material in the form of slabs or sheet bars.

Some sheets coming under the head of advanced sheets as treated in this survey are hot rolled. Thus sheets rolled in grooves or corrugated are made from the hot metal on rolls grooved longitudinally. In addition to sheets of this character, there are others manufactured from crucible or electric-furnace steel or from special or alloyed steels. Such sheets are valued more highly than the common Bessemer or open-hearth product.

KINDS, USES, AND METHODS OF PRODUCTION.

Blue-annealed sheets, are sheets generally 16-wire gauge or thicker, which have been subjected to the process of open annealing. Such sheets, when galvanized, are often used by ice manufacturers.

Blue or open annealing consists of the conveyance of sheets singly through a continuous-type heating furnace where the surfaces are exposed for a few minutes directly to the naked flame. After being annealed the sheets are placed on a stretching machine which

stretches them approximately one-quarter of an inch and loosens any scale. Blue annealing removes crystallization, improves the texture, and gives the steel a bluish appearance which accounts for the name given to the process. Blue annealing does not represent any great advance over ordinary hot rolling, and the prices quoted for sheets which have been subjected to this process are only a little higher than those quoted for hot-rolled plates and sheets of the same gauge and material.

Box annealing, which must not be confused with blue annealing, consists in reheating the sheets without contact with the naked flame in order to prevent scaling. The purpose of box annealing is to improve the texture of the steel and soften it. After hot rolling, the steel is generally hard and needs treatment to soften it. The annealing is done in boxes. Approximately 15 to 30 tons of sheets are piled on a cast-iron bottom. A cover is placed over the sheets and its bottom edges banked with sand to exclude the air. The box on the under side is built with an inverted V-slotted track. A similarly shaped track is laid on the floor and extends inside the furnace. Cast-iron balls are placed in the grooves of the tracks, and by means of an electrically driven pusher this box and its contents are rolled into the furnace.

The furnace usually has a capacity of four boxes. When the furnace is charged, heat is applied until a temperature of 1,400 to 1,600° F. is reached. The sheets remain in the furnace from 24 to 48 hours, the temperature being reduced toward the latter part of the annealing. The box is then withdrawn from the furnace and allowed to stand capped for approximately 24 hours. If air is allowed to enter the box shortly after it has been withdrawn from the furnace, a deep-blue color will be imparted for a few inches on the sheets near the edges while the center will be a light gray. Cooling the sheets slowly leads to a fine finished surface.

If the order for this product specifies close-annealed black, the sheets are ready for inspection and shipment. If, however, the order calls for a close-annealed cold-rolled product, they are transferred to the cold-rolling department.

Cold rolling consists in passing the annealed sheets through a pair of rolls similar to those in the hot mill. It is a form of cold working by which the strain on the cold metal is slightly beyond the elastic limit. Cold hammering and drawing are other forms of cold working by which the cross-sectional area is slightly reduced. Cold-rolled steel is used for a number of articles requiring smooth, even surfaces. For exactness of dimensions and very high uniform quality, as in saws, skates, stampings, razors, cutlery, machinery, and the like, cold rolling is practiced.

After cold rolling the metal is sometimes annealed again to restore the original softness and ductility which are reduced by cold rolling. In drawing the metal, annealing may be resorted to several times during the process. Cold rolling may also take place more than once.

Pickling consists in treating sheets with dilute sulphuric acid to obtain a clean surface by removing scale (oxide). This treatment is employed on sheets to be coated with tin or terne (tin or terne plate) or zinc or spelter (galvanized sheets) to protect them from corrosion. In pickling, the sheets are immersed in a bath of diluted sulphuric acid and then rinsed in water. For pickling light-gauge material

without the correlated danger of unnecessary loss of metal, the strength of the acid bath is held between 2 and 4 per cent. Where heavy, unbroken oxide scale is to be removed a 7 or 8 per cent acid solution is used. (For further detail see Surveys on Tin and Terne Plate and on Galvanized Sheets.)

Polishing and planishing consist of applying various abrasives such as emery, rouge, etc., of successive degrees of fineness. The sheets so treated have a brilliant metallic luster. They are used for furniture, piping, automobile parts, engravers' lithographs, hardware, machinery, metallic mirrors, etc.

Painted or decorated sheets are sheets painted or varnished, by dipping or spraying, or rolled or stamped to shape or patterned. Such sheets are used for a variety of purposes such as boxes, furniture, filing cases, ceilings, and the like. Japanned sheets are those having a brilliant hard varnish.

Calendared sheets are those glazed by pressure and are used for parts requiring a hard-glazed surface.

Russia sheet iron is a high-grade, smooth, glossy sheet iron, not liable to rust, and made by a process which for a long time was a secret with Russian manufacturers. The sheets used in the production of this material were subjected to severe hammering in piles with powdered charcoal between them.

Corrugated sheets have a surface with alternate ridges and grooves, furrowed or wrinkled. They are usually rolled hot. Crimped sheets are folded or plaited in small undulations or with edge folded.

ORGANIZATION AND GEOGRAPHICAL DISTRIBUTION.

Sheets subjected to the annealing, pickling, and cold-rolling processes are very largely made in mills or by concerns producing the hot-rolled material. They are, therefore, the products of concerns having large capital. Common black sheets, however, are sometimes sold to companies carrying the productive processes beyond the stage of ordinary hot-rolling.

Polishing, decorating, painting, and kindred processes are more specialized. This work is done on a smaller scale than that involved in annealing, pickling, and cold-rolling. The products have more limited and special uses, and the capital invested is smaller.

The manufacture of sheets up through the stage of cold-rolling takes place, for the most part, in the States where the bulk of the hot-rolled sheets are made, i. e., Pennsylvania and Ohio. Much of the more advanced product is also produced in these States, but there are also mills and shops scattered over a more extensive area in which sheets are treated. The bulk of the output is manufactured in the northeastern part of the country.

PRODUCTION AND CONSUMPTION.

Published statistics do not show the country's output and consumption by kinds of sheets. Figures with reference to total output, exports, and imports, coupled with what is known of the uses of sheets in this country, show that the production and consumption are both large and that the bulk of the sheets are of domestic origin. The country's production of sheets in 1919 amounted to 3,481,493 gross tons. The imports (general) of iron and steel sheets and

plates of all kinds amounted to only 1,095 gross tons, while the exports of steel sheets of all kinds aggregated 177,467 gross tons. These figures show that of the sheets of any grade of manufacture which are consumed in any considerable quantitites in the United States the chief reliance is upon the domestic product. For sheets generally, as shown in the Survey on Iron and Steel Sheets, production exceeds consumption.

DOMESTIC EXPORTS.

The figures published by the Bureau of Foreign and Domestic Commerce show only the exports of steel sheets of all grades and of iron sheets and plates. In 1919 exports of steel sheets amounted to 177,467 gross tons (397,525,194 pounds), and those of iron plates and sheets to 39,892 gross tons (89,358,285 pounds).

FOREIGN PRODUCTION.

As shown in the Survey on Iron and Steel Sheets, the United Kingdom had an output in 1919 of 1,103,419 tons of iron and steel sheets. Of this amount, 212,698 tons consisted of black plate, which is composed of sheets already subjected to the processes of annealing, cold-rolling, and pickling (see Survey on Tin and Terne Plate) and sold as such in the trade. The remainder consists of iron and steel sheets, a large part of which will be subject to the same or other advanced processes preparatory to tinning, galvanizing[1] or polishing and decorating. Other countries producing sheets subjected to advanced processes are Germany, Sweden, and Belgium.

IMPORTS.

In 1919 (calendar year) the imports of iron and steel sheets and plates amounted to 2,473,870 pounds (1,097 gross tons). About half of this importation consisted of hot-rolled sheets and plates made by the Bessemer or open-hearth process and not containing alloys. About 630,134 pounds (281 gross tons), or over one-fourth of the total importation, consisted of sheets and plates made by the crucible, electric, or cementation process, with or without alloys. Of this amount 531,322 pounds were finished only to the stage of hot-rolling and hammering and 98,405 pounds were cold-rolled but not polished or otherwise finished beyond the stage of cold-rolling.

At least half of the imported plates and sheets are the hot-rolled product, and over half of the remainder consists of sheets and plates made of high-grade steel. The percentage of imported iron and steel sheets which have advanced as far as the stage of cold-rolling is not large, and the proportion of polished, painted, and otherwise highly finished sheets negligible.

PRICES.

The variation in the prices of sheets advanced beyond the stage of hot-rolling has been practically the same as that of common black sheets. Blue-annealed sheets, Nos. 9 and 10, averaged in price 4.24 cents per pound in 1918, 3.63 cents in 1919, and 4.65 cents in 1920. In the last

[1] National Federation of Iron and Steel Workers, Statistical Report, 1918.

these years quotations ranged from 3.61 cents per pound in Jan 6 cents in August. Box-annealed sheets, one-pass cold-ro 28 gauge, averaged 4.99 cents per pound in 1918, 4.43 cen 9, and 4.35 cents to 6.32 cents in 1920, depending on prompt delivery. As in the case of the blue-annealed product, price years reached their highest point in August, 1920, when thly average for prompt delivery was 8 cents per pound. vember, 1920, this price had declined to 6.25 cents.

Sheets more advanced than cold-rolled are quoted higher, and t de of crucible or electric-furnace steel, materially so.

TARIFF HISTORY.

The general tariff history of iron and steel sheets is given in n survey on this subject, and only mention will be made he course of duties on the advanced grades of sheets. Prior to ific rates were for the most part imposed by the tariff acts o three or four decades upon iron and steel sheets. In add graduated scale of duties based upon the gauge of the sh vision was generally made for sheets and plates of iron or polished, or planished, glanced," or perfected to a stage better of cold-rolled; for those cold-rolled, cold-hammered, and smoo and for plates and sheets, corrugated or crimped. Sheets l el manufactured by the crucible and electric-furnace method ct to higher duties by virtue of the greater value per pc (See Survey on Iron and Steel Sheets.)

In the act of 1913 ad valorem rates are imposed. Cold-r ts and sheets advanced beyond the stage of cold-rolling, l de of crucible or electric-furnace steel or alloyed steel are su a 15 per cent ad valorem rate. Corrugated and crimped sheet dutiable at a 12 per cent ad valorem rate.

COMPETITIVE CONDITIONS.

The importation of iron and steel sheets of all kinds is insignif compared with the country's total output. While no statistic available concerning the domestic production of sheets made b crucible and electric-furnace processes or alloyed with other n the ratio of importation of such sheets to domestic output is prol very small. The country's production of steel made by proc other than the Bessemer and open-hearth is relatively small. output for the year 1919 in terms of ingots and castings may be cated as follows:

	Gro
Crucible steel	(
Electric-furnace steel	3
Miscellaneous	
Total for processes other than Bessemer and open-hearth	4
Bessemer steel	7,2
Open-hearth steel	26,9
Total	34,6

The production of alloy steel ingots and castings during the year aggregated 1,481,188 gross tons. Of this alloy steel 1,43 *gross tons* constituted ingots; and of the steel made by pro

ther than the Bessemer and open-hearth, 198,175 gross tons were ngots.

In 1919 (calendar year) the imports of iron and steel sheets and plates made of crucible or electric-furnace steel or of alloy steels amounted to 281 gross tons. If the same proportion of alloy and electric-furnace or crucible steel ingots produced in the United States were rolled into sheets and plates as in the case of Bessemer and open-hearth steel—approximately one-fifth—the imported product would still constitute less than one per cent of the domestic output. The menace of foreign competition even in this field is apparently not great.

Russian sheet iron, whose process of manufacture was long kept a secret by Russian manufacturers, has been imported, as there was nothing produced at home which exactly filled its place. This product was supplementary rather than competitive.

Concerning sheets advanced beyond the stage of hot rolling, competitive conditions are not very different from those of ordinary hot-rolled sheets. Annealing, hot rolling, pickling, and to a large extent polishing, etc., are machine processes. As in the case of the hot-rolled product, labor cost is an important but not determining item. The raw product at each stage of manufacture is by far the largest item in the total cost of manufacture. The labor element tends to increase in importance as the sheets become more specialized and more highly finished. Up to and including the stage of cold rolling the item of labor, while appreciable, is not of supreme importance. Even in the case of decorated sheets the labor item is not so large as would be supposed. The higher wages paid in the United States are thus, for the present, more than offset by the lower prices prevailing here for ordinary steel sheets (see Survey on Iron and Steel Sheets). There is the further advantage of better organization of the industry in this country than abroad.

While no foreign competition threatens the domestic industry at present, a better organization of sheet-steel manufacture in England and Germany may make these countries more serious competitors in the future. The higher wages prevailing in this country, with a labor cost amounting to from 20 to 30 per cent of the total manufacturing expense, may change the competitive position of the American producer.

TARIFF PROBLEMS.

There is practically no urgent tariff problem with respect to the competitive position of American producers of advanced sheets and iron. Labor cost, however, is an important item in the total expense of manufacture, with some tendency to increase after the stage of cold rolling is passed. The lower per diem wages paid in Great Britain and other countries manufacturing sheets may in the future operate to put the foreign manufacturer at an advantage. At present the resources of the United States in coal and iron, coupled with better equipment in the way of machinery and other appliances, make the position of the American producer tolerably secure.

There are, however, questions regarding classification which deserve some consideration. In addition to a proper separation of sheets and plates there might be an adequate gradation of the different

ages of production from the common hot-rolled product to the highly lished, painted, or decorated sheets, and a proper division of Besse- er or open-hearth steel sheets and those made from crucible, electric, alloy steels. Such a classification is necessary where specific rates e levied because of the varying values of the sheets themselves. It advisable also because of possible changes in the competitive condi- ns obtaining in the manufacture of sheets at different stages of oduction or from different kinds of steel.

A rough classification of sheets with reference to the kind of steel ed is a fourfold one:

(1) Sheets made from Bessemer or open-hearth steel.
(2) Sheets made from crucible or electric furnace steel (including a y small amount made by the cementation process).
(3) Sheets made from alloy steels.
(4) Iron sheets.

The greater part of the sheets produced in the United States come der the first head and are the most cheaply produced of any. ucible and electric-furnace steel is produced in more limited amounts d is much higher in price because of its superiority for certain uses. eets made from such steel are therefore more expensive. Sheets de from alloy steel vary greatly in value owing to differences in ounts and costs of the alloys used in the steel. Iron sheets are oduced in very small amounts in the United States. The iron ployed in this manufacture is more expensive than Bessemer and en-hearth steel.

In addition to this classification, sheets may be divided into plain d corrugated, grooved, or crimped. Sheets of the latter kind are ually somewhat more expensive than the ordinary plain product. hen the latter is made of ordinary Bessemer or open-hearth steel hout alloys and not advanced beyond the stage of hot rolling, it is within the scope of the present survey.

With reference to stages of production a simple classification may be de as follows:

(1) Blue-annealed sheets.
(2) Box-annealed sheets.
(3) Cold-worked (cold-rolled, cold-hammered, and cold-drawn) ets.
(4) Pickled sheets or sheets cleaned with acid.
(5) Sheets finished beyond the stage of cold working.
(6) Russian sheet iron.

This gradation is not entirely sequential. Russian sheet iron, for mple, does not go through the processes of annealing, pickling, etc. ue-annealed sheets are seldom sold to be later box-annealed and d-rolled. As has already been shown, sheets are often reannealed er the process of cold-rolling, and cold-rolling and pickling may be d often are resorted to more than once. Furthermore, the advanced cesses treated in this survey do not embrace the coating or plating ron or steel sheets with other metals or such processes as enameling. Blue annealing is a simple and not expensive process and adds little the price of the sheets. Blue-annealed sheets are usually sold as h without being subjected to any further finishing process. Box nealing, however, is an important stage in the manufacture of most des of advanced sheets and adds materially to their value. Cold- rking, which includes cold rolling, cold hammering, and cold

wing, is another important step in the finishing process, and adds preciably to the value of the product. Cold rolling may be prac-ed more than once where a very smooth finish is desired, and such ditional finish constitutes a material addition to the value of the et. Pickling is a process employed preparatory to tinning or lvanizing. In the United States pickling is generally done by the lls that do the tinning or galvanizing. It is, however, a step in the vancement of sheets to their final form. Iron or steel sheets not tined for tinning, galvanizing, plating, and the like are often ished beyond the process of cold-rolling. The finishing processes yond the stage of cold working are various and can well be grouped der a general head. In the act of 1913 the phraseology employed designate these advanced finishing processes is the following: heets of iron or steel, polished, planished, or glanced, by whatever me designated, including such as have been pickled or cleaned by id, or by any other material or process." It is advisable that the kling or cleaning by acid be treated as a distinct stage, as it is sus-ptible of a distinct and well-defined classification. The processes of lishing, planishing, and similar operations beyond cold-working can grouped under the general head of "sheets finished beyond the ge of cold-rolling."

Russian sheet iron is a distinct kind of sheet rather than a grade in e series of stages just mentioned. As has already been indicated, wever, it has been subjected to an advanced treatment for a special-ed use. It should, therefore, receive mention as one kind of sheet n.

Under present conditions the revenue possibilities in the case of iron d steel sheets advanced beyond the stage of hot rolling are not eat. In the calendar year 1919 the revenue derived from the impor-tion of iron and steel sheets and plates of all kinds amounted to 7,898. From this figure have to be subtracted $11,423 collected m importation of common hot-rolled sheets and plates and $4,278 the galvanized product. Besides these amounts there are the ties collected on plates which are not separately stated, but which ould also be subtracted. The duties collected on sheets and plates all kinds during the years 1910 to 1919, inclusive, have varied from 3,338 in 1915 to $93,812 in 1910. Since 1914 when the war broke t the maximum revenue yielded in any one year was $72,902 in 1918.

ets blue annealed, Bessemer, Nos. 9 and 10—Prices, wholesale, in cents per pound, f. o. b. Pittsburgh.

[From the Iron Age.]

Months.	1918	1919	1920	Months.	1918	1919	1920
uary	4.25	3.90	3.61	August	4.25	3.55	6.00
ruary	4.25	3.90	4.25	September	4.25	3.55	5.50
h	4.25	3.81	4.50	October	4.25	3.55	5.00
l	4.25	3.55	4.50	November	4.25	3.55	4.58
	4.25	3.55	4.50	December	4.09	3.55	3.62
	4.25	3.55	4.50				
	4.25	3.55	5.20	Average	4.24	3.63	4.65

Sheets, box annealed, one-pass cold-rolled Bessemer, No. 28—Prices, wholesale, in per pound, f. o. b. Pittsburgh.

[From the Iron Age.]

Months.	1918	1919	1920		Months.	1918	1919	192	
			Indefinite delivery.	Prompt delivery.				Indefinite delivery.	P
January	5.00	4.70	4.35	.....	August	5.00	4.35	4.35	
February	5.00	4.70	4.35	4.85	September	5.00	4.35	4.35	
March	5.00	4.61	4.35	5.93	October	5.00	4.35	4.35	
April	5.00	4.35	4.35	6.50	November	5.00	4.35	4.35	
May	5.00	4.35	4.35	6.50	December	4.85	4.35	4.35	
June	5.00	4.35	4.35	6.50					
July	5.00	4.35	4.35	7.65	Average	4.99	4.43	4.35	

TIN AND TERNE PLATE.

SUMMARY.

DESCRIPTION.

Tin plate consists of steel plate coated with tin, and is used in the manufacture of tin cans and other tinned articles. Terneplate consists of iron or steel (chiefly steel) plate coated with a mixture of lead and tin, and is used mainly for roofing and lining packing cases. Of the tin and terne plates produced in the United States, about 90 per cent consists of tin plate.

DOMESTIC PRODUCTION.

The bulk of the tin plate of the world is produced in two countries—the United States and Great Britain. In 1910 the estimated world output of tin plate was 1,475,000 tons, of which 725,000 tons, or approximately one-half, were credited to the United States. In 1916 this country's production was 2,766,401,227 pounds, or more than 1,200,000 long tons. The country's output for 1919 was 2,578,011,487 pounds, or 1,150,898 long tons.

Processes of manufacture and materials.—In the manufacture of tin and terne plate, black plate is coated on both sides with tin or a mixture of lead and tin. The tin is applied by drawing the plates between rolls immersed in a bath of molten tin. The black plate is manufactured out of sheet bars, which go through processes of hot rolling, pickling, annealing, and cold rolling. Great care is necessary in the preparation of black plate for its tin coating.

Of the materials used in manufacture, the steel and lead are of domestic origin. The tin is imported, coming mainly from the Malay Peninsula, Dutch East Indies, Australia, China, and lately from Bolivia.

Organization and integration.—Tin-plate manufacture shows a distinct tendency toward integration (combination of successive stages of production), which is characteristic of the iron and steel industry in general. Black plate and tin and terne plate tend to be produced by the same establishments. About one-half of the tin-plate output of this country is produced in the mills of the United States Steel Corporation. This proportion (1919), however, is less than in the early years of the corporation's history, and it is noticeable that since the outbreak of war in Europe independent mills have been entering the field.

Localities of production.—Within the United States, tin-plate mills for the most part are located in the great iron and steel region extending from Pennsylvania to Illinois. The former State produces about one-half of the tin plate of the country, and West Virginia about three-fourths of the terne plate. The principal regions of consumption of tin plate, however, are along or near the coast, where the leading canning industries are established.

Production and consumption.—For several years the consumptio and production of tin plate in the United States were approximate the same. Since the outbreak of the war in Europe production h appreciably exceeded home consumption and there has been a lar surplus for export.

Exports.—For many years the exports of tin plate from the Unite States formed but a small percentage of the country's output. I 1916, however, with a greatly augmented production, the domesti exports amounted to over 18 per cent of the total output. In tha year the United States became the world's greatest exporter of ti plate, a position which it continued to hold in 1917 and 191 This great increase has been due to the curtailed production Great Britain due to war conditions. Much of the former Britis trade in the Orient and South America has been taken over b American exporters and considerable quantities of tin plate hav been shipped to Great Britain.

History.—Tin-plate manufacture was of little importance in th United States until after the enactment of the tariff of 1890, bu since that time has been a growing industry. The American Ti Plate Co., organized in 1898, and made a part of the United State Steel Corporation in 1901, included mills making the bulk of th domestic product, but during recent years an increasing productio of the country's output is being made by independent concerns.

FOREIGN PRODUCTION.

Next to the United States the United Kingdom is the greates producer of tin plate. Practically all the British output comes fro South Wales, within 20 miles of the port of Swansea. The produc and processes are essentially the same as in the United State although the base box for which prices are quoted weighs 108 pound instead of 100 pounds as with us. Before the war Germany was th third greatest producer but was far behind Great Britain. France Italy, and Spain also produce some tin plate.

IMPORTS.

The importation of tin plate into the United States has declined from over 1,000,000,000 pounds in 1891 to less than 542,000 pounds in 1919. Since 1898 much of the imported tin plate has been reexported in the form of cans and other receptacles. A limited competition with domestic production has also existed from the small proportion of the imports which actually remain in this country fo consumption. When foreign tin plate is used in the United State it is consumed in coastal regions, as the principal markets are there and the cost of transportation to interior points is too high to enabl the foreign product to compete with tin plate produced at home The bulk of imported tin plate comes from the United Kingdom—a other countries combined contributing in late years from about 1 t 10 per cent of the total.

Imports, and revenue therefrom, while showing a general declin since the early nineties, have fluctuated considerably. Immediate after tariff reductions imports have increased temporarily. The was a great decline in imports after the outbreak of war in Europ

During the 10-year period 1907–1917 the revenue derived from imports has varied, in more or less steady decline, from $2,120,292.65 in 1907 to $19,855.80 in 1916. In 1919 (calendar year) it was only a little over $10,000.

Prices.—The price quotations on tin plate in the United States are based upon a box of "coke" tin plate weighing 100 pounds and containing 112 sheets, each 14 by 20 inches, manufactured at Pittsburgh, Pa. During the years 1910 to 1917, inclusive, the average monthly quotations have varied from $3.10 per base box, Pittsburgh, in July and August, 1915, to $12 in July and September, 1917. In 1917 under Government supervision the maximum Pittsburgh price was fixed at $7.75 per base box. In August, 1917, the corresponding price in England was fixed at 30 shillings ($7.307) per base box, when the price of pig tin is £240 ($1,168) per ton. In 1920 the price in the United States averaged 7.53 per base box, Pittsburgh, Pa. In the middle of April, 1921, the price had fallen to 6.25.

Tariff history.—The tariff of 1913, paragraph 109, imposes a duty of 15 per cent ad valorem on "sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tin plates, terneplates, and taggers tin." The manufacture of tin and terne plate became an important industry after the passage of the tariff act of 1890, which raised the duty on the imported article from 1 cent per pound to 2.2 cents per pound. The development of the industry in the United States is often cited as an outcome of the act of 1890, the growth of the industry being very noticeable immediately thereafter. In the fiscal year 1891, just before the act with reference to tin plate went into effect, production in the United States was less than 1 per cent of the amount imported. By 1897 production exceeded importation.

Under the acts of 1894 and 1897 the duties on imported tin plate were 1.2 cents and 1.5 cents per pound, respectively. On account of the industrial depression of the middle nineties, with low prices for iron and steel products in general, these lower duties do not mean much tariff reduction from an ad valorem standpoint. These tariffs, as well as the act of 1909, which restored the duty of 1894, afforded considerable protection to the tin-plate industry. The tariff of 1913, at the then prevailing prices, marked a decided reduction in the duties hitherto prevailing. The outbreak of the war in 1914 prevented direct observation of the effect which might normally follow such a reduction. The fiscal year 1914 showed a marked increase in importation, followed by a great decline during the next three years. At the prices prevailing in 1917 and 1918 the change from a specific duty of 1.2 cents per pound to an ad valorem duty of 15 per cent involved comparatively little alteration in duties.

In some foreign countries substantial duties are imposed. In France the act of 1910 imposed a tariff on tin plate varying from a minimum of $1.05 and $1.14 per 100 pounds to a general duty of $1.23 and $1.31 per 100 pounds. Japan imposes a duty of 20 per cent ad valorem under the law of 1912. Canada, which receives more of our domestic exports than any other country, has admitted tin plate free under the law of 1912.

Tariff questions involved.—The mill price of tin plate is determined, in the main, by three things: The cost of steel, the price of pig tin, and labor cost. With respect to the first two, the American producer is at no serious disadvantage, compared with his foreign competitors. Evidence seems to show, however, that the labor cost in normal times is materially higher in the United States than in Great Britain, our principal competitor. From the purchase of sheet bars to the boxing of the finished tin plate, the labor element constitutes about 25 per cent of the total cost.

Another factor of importance in connection with the competitive strength of the industry in the United States is the relative transportation costs by rail and water. While the greater part of the tin plate manufactured in this country is produced in the region extending from western Pennsylvania to Illinois, it is very largely consumed on or near the coast. Before the war the cost of shipping tin plate from Great Britain to our coastal districts was less than the freight by rail from our principal manufacturing centers to the coast. The differential in favor of the British producer varied from about 7 or 8 cents per 100 pounds on the Atlantic coast to about 50 or 60 cents per 100 pounds on the Pacific. These differentials would add from 2 to 17 or 18 per cent to the relative production cost of the American manufacturer. The war altered this situation for a time, but with the establishment of peace tnis element of relative transportation costs may figure again as a factor against the American producer.

Effect of the war.—The war has accelerated the growth of the industry in the United States. As other branches of iron and steel manufacture in the United Kingdom were considered by the British Government to be of greater present importance, tin-plate production, for a time at least, declined. The place of Great Britain as greatest exporter of tin plate has been taken by the United States. The price of tin plate in both countries greatly increased, the prices fixed under governmental supervision for the base box in each country having been more than double the prewar prices.

Tin and terne plate—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.	
				Imports.	Exports.
	Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1910	1,619,005,000	154,588,076	26,168,315	9.55	1.62
1911	1,736,070,000	95,188,130	70,199,399	5.42	4.00
1912	2,157,055,000	6,248,809	181,899,366	.29	8.43
1913	1,845,130,000	28,345,141	164,362,281	1.54	8.91
1914	[3] 2,085,980,000	49,675,786	105,809,702	2.38	5.07
1915	2,365,295,700	10,926,504	179,221,644	.46	7.58
1916	2,766,401,227	1,712,230	516,257,473	.06	18.66
1917	[4] 3,386,200,000	1,360,953	521,861,490	.04	15.41
1918	3,301,624,244	71,403	560,008,432	.002	16.96
1919	2,578,011,487	156,477	527,461,755	.006	20.46
1918[1]	3,301,624,244	71,403	579,125,457	.002	17.54
1919[1]	2,578,011.487	541,912	458,127,594	.021	17.77

[1] Calendar years.
[2] Fiscal years.
[3] The Federal Census figure for 1914 is 2,053,966,144 pounds. The figures given above for domestic production are those published by the American Iron and Steel Institute. In the Statistical Abstract, 1916, p. 715, the 1914 figure is the one published by the institute.
[4] American Iron and Steel Institute estimates production at 33,862,000 base boxes or 3,386,200,000 pounds. Later figures recently (1919) published for 1917 is 3,387,206,564 pounds. Annual Statistical Report of American Iron and Steel Institute, p. 53.

NOTE.—Included in the figures for imports are small amounts of tin plate coated with other metal.

Tin and terneplate—Summary table—Continued.

Year.	Value (imports for consumption).[1]	Amount of duty.[1]	Value per 100 pounds.	Equivalent ad valorem rate.
				Per cent.
[illegible]	$4,358,777.00	$1,882,891.61	$2.82	43.36
[illegible]	3,021,081.08	1,134,314.01	3.17	37.83
[illegible]	276,506.00	69,626.89	4.42	26.74
[illegible]	973,005.00	326,554.87	3.43	35.07
[illegible]	1,510,636.24	283,455.14	3.04	19.29
[illegible]	366,989.00	53,168.25	3.36	15.00
[illegible]	132,372.00	19,855.80	7.73	15.00
[illegible]	146,853.00	22,027.95	10.79	15.00
[illegible]	5,964.00	894.60	8.35	15.00
[illegible]	13,523.00	2,028.45	8.64	15.00
[illegible][2]	5,964.00	894.60	8.35	15.00
[illegible][2]	66,944.00	10,041.60	12.40	15.00

[1] Fiscal years. [2] Calendar years.

NOTE.—In computing equivalent ad valorem rates, only the amounts and values bearing import duties were considered. The following amounts with the values were admitted free:

	Pounds.	Value.		Pounds.	Value.
[illegible]	561,295	$16,511.00	1913	1,132,237	$41,785.00
[illegible]	661,961	22,644.58	1914	1,258,769	40,776.00
[illegible]	446,569	16,107.00	1915	364,582	12,534,00

GENERAL INFORMATION.

DESCRIPTION OF ARTICLE.

Tin plates consist of thin steel plates coated on both sides with tin, in order to prevent rusting. From 2 to 6 pounds of tin per 100 pounds of steel are employed in the process of tinning. The more tin used the higher the grade. The unit of production is the base box of 100 pounds, containing 112 sheets, each 14 inches wide and 20 inches long. Market quotations are based on coke tin plate of the size and weight described. Coke tin plate is coated with 2 to 3 pounds of tin per 100 pounds of steel. Charcoal finished tin plates are coated with 5 to 6 pounds of tin per 100 pounds of steel and brings higher prices. The terms "coke" and "charcoal" have no special significance other than the thickness of the tin coating.

While the unit of production is the base box of 100 pounds containing 112 sheets, 14 by 20 inches, there is great variation in the size and weight of tin plates and in the total weight of the box. The boxes usually range in weight from 55 pounds to 195 pounds and the grades of plate from common coke through several kinds of charcoal plate.

Terneplates are steel sheets coated with a mixture of tin and lead, the proportions of the two varying. A common mixture is one-third tin and two-thirds lead. "Taggers" are plates which are undersized and run below the guage of the box for which they are made. "Wasters" is a term employed to designate defective plates, containing "pinholes."

In the United States tin plates are produced in much larger quantities than terneplates. Out of a total of 2,578,011,487 pounds of these plates, produced in 1919, 2,407,156,757 pounds, or over 90 per cent, were tin plates.

USES OF TIN AND TERNE PLATES.

The principal uses of tin plates are found in the manufacture of tin cans for provisions, fruits, milk, tobacco, gasoline, kerosene, etc. The higher-priced plates—charcoal tin plates—are used for milk churns and cans for fish and fruits, as chemical action would eat through the more thinly coated and cheaper plates. Terneplates are largely used for roofing and for lining packing cases. "Wasters" are employed in the production of cheap kitchen utensils and toys, such as are sold in 5 and 10 cent stores.

Since the beginning of the war other uses were found to a limited extent for tin plates, such as linings for ammunition cases, hand grenades, eyelets for gas helmets, and small inner cases for shrapnel shells.

HISTORY.

Tin plates were apparently known in ancient times, as mention is made in Pliny (A. D. 23) of iron and copper, coated with tin. They have been produced in modern Europe for some centuries. Tin plates, including terneplates, were first made in the United States for commercial purposes in 1872, but this production soon ceased on account of foreign competition. The tariff act of 1883 fixed a duty of 1 cent a pound on tin plate, but this tariff, like earlier ones, did not afford the protection which would enable the industry at that time to take root on American soil. The passage of the act of 1890 fixing a duty of 2.2 cents per pound upon tin plate helped to establish the industry in this country upon a permanent basis. The importation of tin plate reached its culminating point in the fiscal year 1891, after which the provisions of the new law with reference to tin plate took effect. The importation of tin plate for 1891 reached a total of 1,036,489,074 pounds, and the domestic production was less than one-half of 1 per cent of the amount imported. From 1891 to the present time the decline in importation has been marked and continuous. In 1897 the output in the United States for the first time exceeded the amount imported. In recent years most of the tin plate imported has been reexported, the manufacturers obtaining the benefit of the drawback provision of recent tariffs.

The duty on tin plate was reduced from 2.2 cents per pound to 1.2 cents per pound in the act of 1894. The act of 1897 increased this duty to 1.5 cents per pound. The industrial depression of the middle nineties, accompanied by great increases in efficiency on the part of American workmen, resulted in greatly reduced prices. From an ad valorem standpoint the duties of the acts of 1894 and 1897 did not, therefore, mean a greatly reduced tariff. The act of 1909 restored the rate of 1894. The present tariff fixes a duty of 15 per cent ad valorem on tin plate.

Since the outbreak of the war our exports of tin plate have greatly increased, and much of the foreign trade in tin plate enjoyed by Great Britain has been taken over by the United States. While the United

ates has been the leading producer of tin plate for a number of ars, it is only in the last two years that our exports have exceeded ose of Great Britain.

PRICES OF TIN PLATE AND TERNEPLATE.

Until after the passage of the act of 1890 nearly all the tin plate nsumed in the United States was of foreign production. From 879 to 1891, inclusive, the annual average New York price per box f 108 pounds [1] of ordinary Grafton or J. B. coke tin plate varied rom $6.75 in 1880 to $4.30 in 1886. The corresponding prices of verage charcoal tin plate were 90 cents to $1.25 per box higher.[2]

Bessemer coke tin plate of domestic manufacture sold in New York City at $5.20 per box of 108 pounds and $4.97 per box of 100 pounds on October 24, 1892. On January 28, 1895, the price at Pennsylvania mills was $3.68 per box of 108 pounds and $3.45 per box of 100 pounds. To these prices 15 cents for freight should be added in order to obtain the New York price.[3]

In February, 1898, the price of coke tin plate reached its minimum when it was $2.90 per 100-pound box. It rose again to $4.65 in September, 1899, where it remained until September, 1900. In August, September, and October, 1904, the price was $3.30. It again rose to $3.90 in November, 1906, and there it remained all through 1907. In January and February and July and August, 1915, the average price was $3.10. The quotations for 1916 and 1917 were influenced by war conditions. In December of the former year the average price was $6.63 and in July and September of the following year the quotations averaged $12. The price fixed on the recommendation of the War Industries Board late in 1917 was $7.75.[4] In 1920 the Pittsburgh price of coke tin plate averaged $7.53. In the middle of April, 1921, the Pittsburgh price had fallen to $6.25.

Terneplate prices are generally a little lower than those for tin plate—the fluctuations being practically the same as those for tin plate. When the War Industries Board fixed the price of tin plate at $7.75 per box, the price of terneplate was adjusted at $7.65.

LEADING COUNTRIES PRODUCING TIN PLATE.

The greatest producer of tin plate in the world to-day is the United States—a position which this country has held for several years. In 1910 the estimated world output of tin plate was 1,475,000 tons, of which 725,000 tons, or about one-half, was produced in the United States. The United Kingdom produced approximately 600,000 tons, and Germany, the third greatest producer, had an output of 50,000 tons.[5] France, Italy, and Spain also produce some tin plate.

Of the American production, about half comes from mills in Pennsylvania. British tin plate is practically all produced in South Wales within a radius of 20 miles of Swansea.

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[1] The base price of English coke tin plate is for a box of 108 pounds.
[2] Annual Report of the American Iron and Steel Association for 1911, p. 93.
[3] Ibid., pp. 95-96.
[4] Ibid., p. 76.
[5] Daily and Consular Trade Reports, Feb. 14, 1913, pp. 682-683.

RAW MATERIALS.

The raw materials entering into the production of tin and terne plates are black plates—generally of steel, although iron plates are occasionally used—and tin. In the case of terneplate, lead, which is mixed with tin, is an ingredient. The black plate is of domestic manufacture and is now generally produced by the same establishments that do the tinning. The tin employed in the manufacture of tin plate is nearly all imported. The principal sources of supply have been the United Kingdom and the British and Dutch East Indies—the imports from the United Kingdom, however, being largely transshipments from the Straits Settlements. The Straits Settlements themselves produce no tin, but ship the tin produced in the Malay Peninsula, the islands of Banca and Billiton, Australia, and China. A considerable amount of tin is shipped direct from the Dutch East Indies. The tin imported into the United States comes mainly in the form of bars, blocks, pigs, or grain or granulated tin. Tin scrap fron the United Kingdom and Canada has also been imported. The lead which enters into the production of terneplate is of domestic production.

Since the beginning of the late war some tin has been imported from South America. This tin is produced in Bolivia and much of it comes in the form of tin ore.

The demand for tin in the United States is largely a demand for use in the manufacture of tin plate. Much tin, however, is consumed in the production of bronze, pewter, solder, white metal, antifriction metal, and tin foil. On account of the high prices of tin in recent years less of this product is now used in the manufacture of a given amount of tin plate than formerly—the reduction having been as much as 50 per cent.

PROCESS OF MANUFACTURE.

Tin plate, as has been stated, consists of black plate coated on both sides with tin. In the case of terneplate the coating is a mixture of tin and lead. The tin is applied by drawing the plates between rolls immersed in a bath of molten tin, the rolls pressing the tin into the surface of the plate, which gives a smooth, bright coating to the black plate. Formerly the plates were dipped into the molten metal by persons, generally women, who held the exposed ends of the plate. To-day, however, the tinning or dipping is a regular machine process.

In the manufacture of tin plate the stages of production anterior to tinning are important, as care must be exercised in the preparation of the plate before it is ready for tinning. In the stages subsequent to tinning there is involved certain costs which add materially to the price which the purchaser of the tin plate has to pay. Put in a sequential order the manufacture of tin plate consists of the following operations: The shearing of the tin plate bars, which are the raw material of the black plate which receives the tin coating; heating the bars; roughing the bars, now called pairs; matching; doubling and shearing; reheating the sheets; finishing the pack; opening the pack; black pickling; annealing; cold rolling; then white pickling, tinning, branning, assorting, and packing.

The bars which constitute the raw material of the plate ready for tinning are either 7 or 8 inches wide and of varying thickness (the

thickness of the bar being determined by the thickness or the gauge of the finished plate), usually three-sixteenths to three-eighths inch. They come from the steel works in about 30-foot lengths.[1] Of the operations named above, the most important single one is the heating of the bars. These bars must be brought up to the rolling temperature with a slow, even rise of temperature. A sudden heating scales the bars and this scale is rolled into the pack, spoiling the sheet. The operations of black and white pickling are to remove scales, dirt, mill grease, etc. Absolute cleanliness is essential to success. Any defect in the plate which prevents uniform tinning spoils the tin plate. Any exposure to atmospheric action of any part of the steel plate after it is tinned on account of "pinholes," or wearing away of the tin, will cause more rapid oxidation of the steel than if the plate had not been coated with tin.

Nearly all the operations are by machinery. Assorting, however, is performed by manual labor, nearly always by female labor. The work is light and women can perform this work as well as men. After leaving the assorting room the plates are ready for packing. It is usual to have a box factory in connection with the warehouse. The boxes in which the plates are packed vary in size, but the commonest size is 14½ by 20½ inches, inside. The plates are packed in the box on a layer of brown paper and likewise so covered. The lid is nailed down and the box is properly branded with the quality, contents, and mark.[2]

COST OF PRODUCTION.

In 1913 the Commissioner of Corporations in his Report on the Cost of Production in the Steel Industry, published figures on the average book cost of producing black plate used for tinning and tin plate for the years 1902–1906. While costs are materially different to-day, these figures give some idea of the items which enter into the cost of production and their relative importance. These costs are shown with reference to black plates and tin plates as follows:[3]

Average book cost of black plate used for tinning, 1902–1906.

[In dollars per gross ton.]

	Average for 5 years, 1902-1906.		Average for 5 years, 1902-1906.
Hot rolling:		Annealing:	
Sheet bars	$25. 25	Labor	$0. 57
Labor	12. 73	Other items	. 79
Fuel	. 47	Cold rolling:	
Steam	1. 45	Labor	. 49
Rolls	. 60	Other items	. 24
Supplies and tools	. 74	Mill cost	46. 85
Miscellaneous and general works expense	1. 08	Additional cost:	
Pickling:		General and miscellaneous expense	1. 53
Labor	. 40	Depreciation	. 61
Other items	2. 04	Total book cost	48. 99

[1] Iron Age, Jan. 3, 1918, p. 30.
[2] Iron Age, Jan. 3, 1918, p. 127.
[3] Report of Commissioner of Corporations on The Steel Industry, Pt. III, pp. 255, 256, and 259. While this report deals with costs of manufacture for steel-producing companies in general during the years 1902–1906 and for the United States Steel Corporation for the year 1910, its figures are of value in this inquiry. In addition to being a careful and detailed study of steel costs, it is practically the only one outside of steel industry itself which can be called authoritative. Later figures, less detailed, were furnished the Tariff Commission for the last quarter of 1917 and for 1918 by quarters by the Federal Trade Commission. These figures are in tentative form and subject to revision before being published.

In producing black plate for tinning, the cost of the sheet bars was the most important single item—$25.25 out of a total book cost of $48.99. The cost of transforming sheet bars into black plate ready for tinning then amounted to $23.74. Of this manufacturing cost the labor element constituted about 60 per cent ($12.73 plus $0.49 plus $0.57 plus $0.49=$14.19).

The average book cost of producing tin plate for the same years was computed as follows:

Average book cost of tin plate for years 1902–1906.

[In dollars per box of 100 pounds.]

Black plate	$2.04	Additional cost:	
Pig tin	.63	General and miscellaneous expense	$0.10
Labor	.19	Depreciation	.04
Wasters	.04		
Flux, fuel, and supplies	.11	Total book cost	3.18
Materials in repairs and maintenance	.01		
Miscellaneous and general works expense	.02		
Mill cost	3.04		

Of the items entering into cost of producing tin plate, the cost of black plate constituted nearly two-thirds of the total book cost. Of the spread between black plate and the finished product, the cost of pig tin was by far the most important element, being nearly 60 per cent of the total spread.

INDUSTRIAL INTEGRATION.

According to the latest report of the United States Census there were, in 1914, 35 establishments engaged in the manufacture of black plates and tin and terneplates as against 66 in 1899. Of the 35 establishments existing in 1914, 28 rolled black plate and dipped the plates; 4 rolled black plate, but did no dipping; and 3 did tin and terneplate dipping only. In other words, only one-fifth of the total number of establishments was confined to one or the other of these two branches of manufacture. In 1899, 31 out of 66 establishments, or nearly half, were engaged in only one or the other of these branches. There is thus a tendency for establishments to secure control over successive stages of manufacture in the tin-plate industry.[1]

In 1914 there were 23 establishments each of which reported products valued at $1,000,000 and over as compared with 18 in 1909 and 12 in 1904. The average value of products per establishment increased from $980,000 in 1904 to $2,205,000 in 1914.[2] This increase was not due to higher prices in the latter year, as prices in 1914 averaged somewhat less than in 1904, but to greater amount of product.[3]

About half of the tin plate of the country is produced by the United States Steel Corporation (American Sheet & Tin Plate Co.).

[1] U. S. Census of Manufactures, 1914. Iron and Steel, pp. 60–61.
[2] Ibid., p. 63.
[3] Iron Age, Jan. 3, 1918, p. 76. Note prices listed for 1904 and 1914.

MANUFACTURING AND CONSUMING REGIONS.

According to the Census Report of 1914, Pennsylvania produced that year over 60 per cent of the tin-plate products of the country. West Virginia produced over 80 per cent of the terne plates.[1] Other States producing tin and terne plates are Ohio, Illinois, and New York.

About two-thirds of the tin plate of the country is consumed on or near the coast. This is due to the fact that the largest canneries are along the coast within easy reach of our principal fish and fruit producing regions. The proportion of domestic tin plate utilized in the coastal regions of the country seems likely to increase in view of the fact that much less tin plate is now being imported from the United Kingdom than formerly. Many concerns, like some of the Standard Oil companies, used foreign tin plate in their export trade, but under war conditions were obliged to rely on domestic tin plate. The exports of tin plate have increased greatly in the last five years. Canada has been our principal customer, but the exports to Argentina, China, British India, Japan, and Brazil have also been large.

DEPENDENT INDUSTRIES.

The industries most vitally concerned in the production of tin plate are the canning industries. The preservation and shipping of fish, fruit, oil, etc., in cans and other tinned receptacles is of great and growing importance. Some tin plate is also used in the manufacture of cheap household utensils and toys, the producers of which depend upon the supply of tin plates. The manufacturers and users of certain kinds of packing cases and roofing are affected by the production of terne plates.

SEASONAL CHARACTER OF THE DEMAND.

A large proportion of the tin-plate consumption is seasonal in character. The demand for this commodity is for plate of regular size and standardized grades. While requirements are to a considerable extent anticipated several months ahead, the need is great in the canning season. Seasons, however, vary in the amount of fruit, fish, etc., available for canning, and the uncertainty of the seasonal demand accentuates the seasonal variation.

COST OF PRODUCING TIN PLATE IN WAR PERIOD.

The Federal Trade Commission, in the determination of the costs of iron and steel products during the war for the use of the price fixing committee of the War Industries Board and of certain purchasing departments of the Government, obtained the monthly cost sheets of the producing companies showing the average mill cost of producing coke tin plate from October, 1917, to December, 1918, inclusive. These cost sheets were for mill costs and did not cover general and administrative expenses or general depreciation. At the request of the Tariff Commission for information respecting the

[1] U. S. Census of Manufactures, 1914. Iron and Steel, p. 65.

proportion of the various items of cost to the mill cost, the Federal Trade Commission compiled the costs as reported by five representative companies. They did not, of course, include any items for interest or for income or excess profits taxes. If the additional costs for general and administrative expenses and for general depreciation could be determined with accuracy, there would be a substantial addition to the mill cost as shown below.

These data have not as yet been published by the Federal Trade Commission and were furnished to the Tariff Commission with the statement that they were subject to revision. While these figures give the reported mill costs for only five companies, it is believed that they are sufficiently representative to show the relative importance of the particular items entering into mill costs. For quarterly periods these costs were as follows:

Average mill cost of coke tin plate of five representative companies, by quarters, October, 1917, to December, 1918.

[In dollars per base box.]

Item of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	October to December.
Production base boxes (100 lbs. each)	7,052,924	5,887,254	7,561,542	7,275,451	5,762,388
Net metal	$4.48	$4.81	$4.87	$4.98	$5.37
Fuel	.03	.03	.01	.01	.03
Labor	.38	.37	.27	.32	.34
Maintenance and repairs	.04	.04	.05	.05	.05
Rolls					
Steam and power	.01	.01	.01	.01	.01
Rebuilding and contingent					
Other costs	.30	.36	.32	.35	.40
Mill cost	5.24	5.62	5.53	5.72	6.21
PER CENT OF MILL COST.					
Net metal	85.50	85.59	88.07	87.08	86.47
Fuel	.57	.53	.18	.17	.48
Labor	7.25	6.58	4.88	5.60	5.46
Maintenance and repairs	.76	.71	.90	.87	.97
Rolls					
Steam and power	.19	.18	.18	.18	.16
Rebuilding and contingent					
Other costs	5.73	6.41	5.79	6.12	6.44
Mill cost	100.00	100.00	100.00	100.00	100.00

Tin plates and terneplates—Production in United States.

[From Federal census.]

States.	1899		1904		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Pennsylvania	334,008,980	$12,401,252	583,599,140	$18,928,397	695,377,287	$25,750,730
Ohio	162,310,304	5,800,703			212,737,039	7,669,423
Illinois	47,286,727	1,939,489			[1]257,807,156	[1]8,922,089
New York	9,491,050	463,199				
All other	295,886,961	10,619,502	442,785,711	15,621,146	149,391,650	5,472,974
Total	849,004,022	31,284,145	1,026,384,851	34,549,543	1,315,313,132	45,815,146

[1] *West Virginia.*

Tin plates and terneplates—Production in United States—Continued.

States.	1914		States.	1914	
	Quantity.	Value.		Quantity.	Value.
	Pounds.			*Pounds.*	
Pennsylvania	1,152,867,757	$35,567,823	All other	158,056,511	$5,427,428
Ohio	325,180,210	10,389,051			
West Virginia	417,861,666	14,886,043	Total	2,053,966,144	66,270,345

Tin plates—Production in United States.

[From Federal census.]

States.	1899		1904		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Pennsylvania	256,879,332	$9,137,483	524,905,922	$16,547,120	648,502,133	$21,687,493
Ohio	132,163,383	4,623,930	.....	.....	157,584,871	5,500,501
Illinois	47,296,727	1,999,489	.....	.....	[1] 189,239,233	[1] 6,360,880
New York	5,591,050	258,199	.....	.....	.....	.....
All other	265,787,747	9,533,920	342,621,063	11,882,551	128,642,638	4,711,011
Total	707,718,239	25,553,021	867,526,985	28,429,971	1,123,968,875	38,259,885

States.	1914		States.	1914	
	Quantity.	Value.		Quantity.	Value.
	Pounds.			*Pounds.*	
Pennsylvania	1,145,846,518	$35,253,572	All other	149,766,539	$4,913,035
Ohio	302,157,513	9,559,255			
West Virginia	303,561,325	10,532,162	Total	1,901,331,895	60,258,024

[1] West Virginia.

Terneplates—Production in United States.

[From Federal census.]

States.	1899		1904		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Pennsylvania	77,129,648	$3,263,769	58,693,218	$2,381,277	46,875,154	$2,063,258
Ohio	30,146,921	1,176,773	.....	.....	55,152,168	2,168,922
New York	3,900,000	205,000	.....	.....	[1] 68,567,923	2,561,219
All other	30,109,214	1,085,582	100,164,648	3,738,295	20,749,012	761,862
Total	141,285,783	5,731,124	158,857,866	6,119,572	191,344,257	7,555,261

States.	1914	
	Quantity.	Value.
	Pounds.	
Ohio	23,922,697	$829,796
West Virginia	114,300,341	4,353,881
All other	15,311,211	828,644
Total	152,634,249	6,012,321

[1] West Virginia.

Tin and terneplates—Production in United States.

[From Annual Reports of the American Iron and Steel Association for 1910–1912 and Annual Reports of the American Iron and Steel Institute for 1913–1919.]

States.	1910	1911	1912
	Pounds.	*Pounds.*	*Pounds.*
Pennsylvania	976,814,000	1,078,962,000	1,261,340,000
New York and West Virginia	280,149,000	326,025,000	[1] 433,574,000
Ohio, Indiana, Illinois, Michigan	362,043,000	351,083,000	462,141,000
Total	1,619,005,000	1,756,070,000	2,157,055,000

States.	1913	1914	1915
	Pounds.	*Pounds.*	*Pounds.*
Pennsylvania	1,070,812,000	[2] 1,151,830,000	[2] 1,226,544,484
Maryland and West Virginia	383,767,000	[2] 328,350,000	[2] 402,886,832
Ohio, Indiana, Illinois, Michigan	390,551,000	[2] 459,605,000	[2] 572,393,748
Total	1,845,130,000	2,085,980,000	2,365,295,709
Total tin plate	1,708,186,000	1,939,785,000	2,201,825,056
Total terneplates	136,944,000	[2] 146,195,000	[2] 163,470,646

States.	1916	1917	1918	1919
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Pennsylvania	[2] 1,379,942,954	[2] 1,637,243,622	[2] 1,603,920,721	1,257,237,193
Maryland and West Virginia	[2] 459,322,751	[2] 504,048,357	[2] 620,333,953	[2] 456,491,227
Ohio, Indiana, Illinois, Michigan	[2] 712,958,570	[2] 1,032,022,032	[2] 991,893,001	693,428,347
Total	2,706,401,227	3,387,206,564	3,301,624,244	2,578,011,467
Total of tin plate	[2] 2,552,224,275	[2] 3,233,314,911	[2] 3,216,247,675	2,407,156,757
Total of terneplate	214,176,952	153,891,653	85,376,569	170,854,730

[1] Production all in West Virginia.
[2] In reports for 1914, 1915, and 1916 only the production of tin plates is classified by the States. The figures for terneplate are given for the country as a whole during those years. For the year 1913 the figures are for both tin plates and terneplates.
[3] Tin plate only.

Tin plates and terneplates—Production in principal foreign countries.

[Figures are in tons: Gross tons for United Kingdom and metric tons for continental Europe.]

Countries.	1907	1908	1909	1910	1911	1912	1915	1916	1917	1918
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
United Kingdom	[1] 695,000	[2] 529,000				[3] 820,000	603,386	576,787	[4] 345,990	416,569
Germany and Luxemburg			[5] 55,427	[6] 57,136						
France				[7] 41,449	[7] 37,471					
Italy		[8] 28,577	[9] 35,880	[10] 27,820						
Spain		[11] 16,131	[11] 11,427	[12] 14,615						

[1] Supplement to Commerce Reports No. 19-C, Nov. 7, 1917, pp. 14–15. Annual statistical reports of tin-plate production in United Kingdom are not gathered and the first authoritative figures of this production were published for the year 1907.
[2] Annual Report of the American Iron and Steel Assn. for 1909, p. 100; figures given for year ending June 30, 1907, or 1908, probably the latter year, as the large exports of tin plate for 1907 would allow too small a tonnage for home consumption in 1908.
[3] Estimated. Daily and Consular Trade Reports, Apr. 4, 1914, pp. 59–60.
[4] Partly estimated.
[5] Ibid for 1911, p. 39.
[6] Annual Report of the American Iron and Steel Assn. for 1911, p. 39.
[7] Ibid, p. 40
[8] Ibid for 1910, p. 112.
[9] Ibid for 1911, p. 46.
[10] Ibid, p. 46.
[11] Ibid for 1911, p. 44. Figures for two works.
[12] Ibid, p. 44.

Tin plates, terneplates, and taggers tin—Imports by countries.[1]

FISCAL YEARS.

Imported from—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
Austria-Hungary			350	$34		
Belgium	147,544	$4,832	61,734	1,631		
Germany	347,102	19,750	123,018	10,112	142,848	$11,121
Netherlands			1,100	63		
United Kingdom	153,704,447	4,315,459	94,759,014	2,993,670	5,954,894	249,626
Canada	367,506	15,088	374,514	16,942	515,135	26,148
Mexico					376	52
Total	154,566,599	4,355,129	95,319,730	3,022,452	6,613,253	286,947

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Germany	135,877	$12,592	235,192	$11,163	259	$26
Russia (Europe)			26,489	1,435		
United Kingdom	27,993,475	946,538	48,501,287	1,460,792	10,462,673	339,373
Canada	214,891	12,690	113,479	7,991	179,305	14,075
Argentina			1,500	77		
Total	28,344,243	971,820	48,877,947	1,481,458	10,642,237	353,474

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	1,709,840	$132,959	1,215,502	$128,676	6,220	$1,164
Canada	86,648	8,470	154,960	19,203	65,183	4,800
Mexico	25	2				
Japan	340	13				
All other						
Total	1,796,853	141,444	1,370,462	147,879	71,403	5,964

[1] From Commerce and Navigation.

CALENDAR YEARS.

Imported from—	1918		1919	
	Pounds.		*Pounds.*	
United Kingdom	6,220	$1,164	473,801	$60,078
Canada	65,183	4,800	67,875	6,838
France			36	18
Dutch East Indies			200	10
Total	71,403	5,964	541,912	66,944

Tin plates: Sheets or plates of iron or steel, or taggers iron or steel coated with tin or lead or with a mixture of which these metals or either of them is a component part, by the dipping or any other process, and commercially known as tin plate, terneplate and taggers tin, etc.—Imports for consumption—Revenue.[1]

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907[2]	1¼ cents per pound.	141,292,832	$4,632,722	$2,120,293	$0.033	45.77
1908[2]	do	140,294,366	4,277,820	2,104,415	.031	49.19
1909[2]	do	117,574,947	3,212,545	1,763,624	.027	54.90
1910	do	11,523,413	302,561	172,851	.026	57.13
1910	1-7/8 cents per pound.	142,503,368	4,039,705	1,710,040	.028	42.33
1911	do	94,526,169	2,998,436	1,134,314	.032	37.83
1912	do	5,802,240	260,399	69,626	.045	26.74
1913	do	27,212,903	931,220	326,554	.034	35.07
1914	do	8,730,296	278,583	104,763	.032	37.61
1914	15 per cent	39,651,295	1,189,484	178,422	.030	15.00
1915	do	10,560,180	354,297	53,144	.034	15.00
1916	do	1,707,647	131,991	19,798	.077	15.00
1917	do	1,354,682	145,948	21,892	.108	15.00
1918	do	71,403	5,964	894	.084	15.00
1919	do	156,477	13,523	2,028	.086	15.00
1918[3]	do	71,403	5,964	894	.084	15.00
1919[3]	do	541,912	66,944	10,041	.124	15.00

[1] See table (below) for quantities on which the duty was omitted.
[2] Totals for sheets of all weights.
[3] Calendar years.

Tin plates on which duty was remitted—Imports for consumption.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				
1907	Sec. 15, act of 1897.	472,706	$15,983		$0.034	
1908	do	488,796	18,470		.038	
1909	do	580,824	18,114		.031	
1910	Sec. 23, act of 1909.	561,205	16,511		.029	
1911	do	661,961	22,644		.034	
1912	do	446,569	16,107		.036	
1913	do	1,132,237	41,785		.037	
1914	Sec. IV M, act of 1913	1,258,769	40,776		.032	
1915	do	364,582	12,534		.034	
1916	do					
1917	do					
1918	do					
1919	do					
1920	do					

Tin plate, terneplates, and taggers tin—Domestic exports.

Exported to—	FISCAL YEAR. 1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
Canada	23,785,216	$826,929	40,017,633	$1,607,458	84,673,582	$2,985,065
Mexico	707,322	26,064	2,229,236	81,653	5,330,178	169,425
Cuba	476,460	16,326	1,654,370	64,336	3,731,069	133,890
Argentina			1,694,653	64,934	7,737,060	255,972
Brazil	80,309	3,210	543,627	19,674	5,667,505	198,931
Chile	35,433	1,286	803,886	30,150	2,953,523	106,043
China	128,494	3,981	7,195,158	248,713	21,978,839	756,609
British India			4,229,274	152,534	19,090,514	636,974
Straits Settlements	190,517	6,261	302,939	10,916	2,764,070	91,067
Hongkong	54,304	1,486	2,460,782	89,283	10,477,833	343,777
Japan	3,140	99	1,586,462	59,596	9,496,165	330,645
All other	707,120	26,529	1,481,378	59,847	7,999,038	270,961
Total	26,168,315	912,171	70,199,398	2,489,094	181,899,366	6,269,325

Tin plate, terneplates, and taggers tin—Domestic exports—Continued.

FISCAL YEAR—Continued.

Exported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Denmark			810	$32	5,722,099	$173,385
Italy					2,238,397	73,099
Netherlands					2,370,991	94,100
Canada	116,578,346	$4,065,672	73,164,530	2,513,867	76,598,944	2,445,529
Mexico	3,884,533	137,891	2,597,800	88,937	5,698,033	175,949
Cuba	5,346,723	194,371	4,407,841	159,430	5,583,471	178,859
Argentina	7,174,782	247,646	2,859,994	94,232	15,281,184	492,941
Brazil	5,962,981	217,139	1,804,915	67,549	7,887,243	242,248
Chile	4,799,351	180,188	4,252,521	157,442	1,671,008	52,835
Uruguay	477,151	18,328	382,314	12,835	5,395,428	178,589
China	5,003,301	178,754	8,988,078	298,977	22,899,804	682,460
British India	1,020,992	35,432	20,370	625	6,746,190	202,938
Straits Settlements	2,903,228	99,946	425,742	14,389	1,171,985	35,989
Hongkong	2,662,643	84,915	3,372,045	106,250	6,503,963	201,603
Japan	2,775,791	93,968	429,371	14,240	4,645,367	154,551
Russia in Asia					3,532,303	152,107
All other	5,772,479	212,793	3,193,431	115,033	5,275,234	174,922
Total	164,362,281	5,767,043	105,899,762	3,643,806	179,221,644	5,712,104

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
France	14,152,743	$539,281	10,602,214	562,774	22,562,028	$2,523,593
Italy	5,813,892	201,960	18,600,771	1,079,031	71,141,529	6,844,679
United Kingdom	66,715,359	2,288,425	19,478,088	$854,090	2,984,516	245,891
Canada	117,364,108	3,979,069	133,625,014	7,691,901	125,109,818	9,936,118
Mexico	6,154,491	211,179	4,384,430	289,728	4,028,273	396,405
Cuba	8,564,353	304,371	8,975,391	535,407	5,018,118	563,212
Argentina	41,926,801	1,519,110	51,378,225	2,954,310	73,507,787	7,811,659
Brazil	24,540,519	860,167	31,174,451	1,718,225	32,655,915	3,671,818
Uruguay	8,422,480	288,931	11,586,175	728,174	27,633,514	2,791,833
China	35,408,911	1,248,678	30,558,220	1,534,253	14,302,220	1,428,545
British India	45,548,953	1,656,154	39,841,103	1,623,500	22,309,038	2,172,083
Straits Settlements	7,259,932	249,192	12,749,138	733,770	10,332,919	947,361
Dutch East Indies	7,959,052	286,808	31,188,323	1,524,074	7,258,226	805,953
Hongkong	31,940,917	1,269,799	22,169,791	1,173,017	23,182,552	2,206,662
Japan	55,189,308	2,315,506	46,430,277	2,742,426	80,687,859	10,478,686
Russia in Asia	10,015,932	420,516	4,180,157	259,154		
Australia	3,870,159	135,708	14,723,896	668,569	2,493,376	156,001
All other	25,409,503	928,919	30,215,595	1,732,020	34,860,744	4,919,197
Total	516,257,473	18,703,773	521,861,259	28,404,423	560,068,432	57,899,696

CALENDAR YEARS.

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
France	30,962,802	$3,004,577	3,008,751	$212,694
Italy	57,117,704	5,329,039	6,972,128	472,325
United Kingdom	313,758	32,220	2,886,294	199,009
Canada	144,960,580	11,638,385	92,288,376	6,691,371
Mexico	4,527,210	471,918	9,575,762	718,318
Cuba	4,357,962	419,935	6,289,947	532,560
Argentina	87,642,433	7,719,007	53,266,486	4,749,534
Brazil	28,087,364	2,731,669	31,500,438	2,723,934
Uruguay	41,495,484	3,545,793	26,865,526	2,180,986
China	24,597,702	2,284,654	37,966,278	3,021,392
British India	13,706,054	1,619,245	23,623,211	1,813,106
Straits Settlements	10,722,934	1,034,007	1,986,668	147,747
Dutch East Indies	10,460,629	1,156,563	4,866,166	445,713
Hongkong	18,136,737	1,938,222	17,690,944	1,378,351
Japan	82,080,957	10,563,457	101,837,517	8,380,041
Russia in Asia			145,008	10,381
Australia	1,444,590	88,290	1,195	87
All other	18,510,557	2,273,313	37,356,899	3,240,025
Total	579,125,457	55,850,294	458,127,594	36,997,634

[1] Included in figures for "other countries."

Tin plate—Prices: Coke, Bessemer, and open-hearth, per 100 pounds, Pittsburgh, Pa.

[From Iron Age, Jan. 6, 1921, and Base Prices, Differentials, and Extras on Iron, Steel, and Non-ferrous Products, fixed under Government supervision.]

Year.	Average.	High.	Low.	Price fixed by Government.	Year.	Average.	High.	Low.	Price fixed by Government.
1910	$3.60	$3.60	$3.60	.....	1916	$5.30	$6.63	$3.75	.....
1911	3.62	3.70	3.40	.....	1917	9.11	12.00	7.00	$7.75
1912	3.45	3.60	3.30	.....	1918	7.75	7.75	7.55	.....
1913	3.55	3.60	3.40	.....	1919	7.08	7.35	7.00	.....
1914	3.28	3.41	3.13	.....	1920	7.53	9.00	7.00	.....
1915	3.19	3.52	3.10	.....					

NOTE.—The average price is a simple arithmetical average of the monthly averages in each year. The quotations high and low are the highest and lowest monthly averages for each year. No average is given for 1917, as no quotations are given for the month of October of that year. The Government price prevailed during the months of November and December and has continued in 1918.

Black sheets, No. 28—Prices, Pittsburgh, Pa., in cents per pound.

[From Iron Age, Jan. 6, 1921.]

Year.	Average.	High.	Low.	Government price.	Year.	Average.	High.	Low.	Government price.
	Cents.	*Cents.*	*Cents.*	*Cents.*		*Cents.*	*Cents.*	*Cents.*	*Cents.*
1910	2.29	2.40	2.15	.....	1916	3.04	4.31	2.60	.....
1911	2.04	2.20	1.83½	.....	1917	5.86	8.50	4.50	5.00
1912	2.00	2.25	1.80	.....	1918	4.99	5.05	4.85	.....
1913	2.12	2.35	1.89	.....	1919	4.43	4.70	4.35	.....
1914	1.88	1.95	1.81	.....	1920	5.83	7.50	4.35	.....
1915	1.91	2.50	1.75	.....					

COURT AND TREASURY DECISIONS.

There has been litigation upon circular flat disks produced in the manufacture of cans from tin plate. Uses to which these disks were put, according to a recent decision (infra), are (*a*) for making tops and bottoms of snuffboxes, (*b*) for roofing caps, and (*c*) for making toy dishes.

Such disks were held by the Circuit Court of Appeals for the Fourth Circuit dutiable under the act of 1897 as articles of metal, not specially provided for, and not as "sheets * * * commercially known as tin plates" nor as an article "manufactured from tin plate." (Shallus *v.* United States, 162 Fed., 653.)

In another court case, referred to above, such disks were held exempt from duty under the acts of 1909 and 1913 as returned American goods not advanced in value or improved in condition while abroad. The contention of the Government that the provision for returned American goods did not apply because tin plate was exported and disks returned was declared contrary to implied legislative approval of prior cases holding merchandise exported from the United States in the form of hoop or band steel, or otherwise, returned to the United States as scrap steel entitled to free entry as goods exported and returned. (United States *v.* Saunders, 8 Ct. Cust. Appls., 82. Two judges dissented.)

Compliance with the regulations of the Treasury Department is essential to free entry. (United States *v.* Saunders, 6 Ct. Cust. Appls., 86.)

NOTE.—Strips of tin 20 inches in length and ¾ inch in width, susceptible of use in the manufacture of toys and as bindings on wooden butter dishes and plates, were held dutiable under the provision in paragraph 134 of the act of 1897 for "sheets coated with tin" and not as "waste" under paragraph 463. (G. A. 5487; T. D. 24801.) Similar strips of tin plate were held not to be dutiable as manufactures of metal under paragraph 177 of the act of 1894.

Tin and terne plate—Rates of duty.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
153	Iron or steel sheets, or plates, or taggers iron, coated with tin or lead, or with a mixture of which these metals is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin.	1 cent per pound.
145	Sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin, until July first, eighteen hundred and ninety-one.	1 cent per pound.
143	* * * On and after July first, eighteen hundred and ninety-one, all iron or steel sheets, or plates, or taggers iron coated with tin or lead, or with a mixture of which these metals or either of them is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin. * * * *Provided further*, That on and after October first, eighteen hundred and ninety-seven, tinplates and terneplates lighter in weight than sixty-three pounds per hundred square feet shall be admitted free of duty, unless it shall be made to appear to the satisfaction of the President (who shall thereupon by proclamation make known the fact) that the aggregate quantity of such plates lighter than sixty-three pounds per hundred square feet produced in the United States during either of the six years next preceding June thirtieth, eighteen hundred and ninety-seven, has equaled one-third the amount of such plates imported and entered for consumption during any fiscal year after the passage of this act, and prior to said October first, eighteen hundred and ninety-seven: *Provided*, That the amount of such plates manufactured into articles exported, and upon which a drawback shall be paid, shall not be included in ascertaining the amount of such importations: *And provided further*, That the amount or weight of sheet iron or sheet steel manufactured in the United States and applied or wrought in the manufacture of articles or wares tinned or terneplated in the United States, with weight allowance as sold to manufacturers or others, shall be considered as tin and terneplates produced in the United States within the meaning of this act.	$2\frac{3}{10}$ cents per pound.
121	Sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin. *Provided*, That the reduction of duty herein provided for shall take effect on and after October first, eighteen hundred and ninety-four. * * *	1¼ cents per pound.
134	Sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin.	1½ cents per pound.
130	Sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin.	$1\frac{7}{10}$ cents per pound.
109	* * * sheets or plates of iron or steel, or taggers iron or steel, coated with tin or lead, or with a mixture of which these metals, or either of them, is a component part, by the dipping or any other process, and commercially known as tinplates, terneplates, and taggers tin, and tin plates coated with metal, and metal sheets decorated in colors or coated with nickel or other metals by dipping, printing, stenciling, or other process.	15 per cent advalorem.

Competitive Conditions.

FACTORS IN COMPETITIVE STRENGTH.

competitive strength of the tin-plate industry is determined in
ain by three things, the price of pig tin, the cost of steel, and
cost. A fourth element affecting marketing possibilities is
t rates. A fifth factor urged by some witnesses in the tariff
gs before the Ways and Means Committee in Congress is invest-
costs.

PRICE OF PIG TIN.

In regard to the price of pig tin, the English manufacturer before the war had not had much advantage over the American producer. Block tin has been sold about as cheaply in New York as in London. A comparison of the prices prevailing at these two great markets will show what the differences are.

Prices of pig tin at New York and London.

[In cents per pound.]

	New York.	London.		New York.	London.
1910	34.12	33.8	1914	34.30	34.6
1911	42.28	41.8	1915	38.59	37.6
1912	46.09	45.4	1916	43.48	38.6
1913	44.25	43.8	1917	61.80	51.7

Before the opening of the present European war the price of pig tin in New York was slightly higher than in London. Since the outbreak of war the difference in price has increased. In 1917 the difference between the New York price and the London price averaged about 10 cents per pound, or about 20 per cent higher in New York than in London. In normal times, however, the American producer can get his tin almost as cheap as his European competitor. The reason for the high price in London, notwithstanding its proximity to Cornwall, is that the Cornish mines do not supply the entire English demand, and the price is governed by the quotations of tin from the Straits Settlements.

COST OF STEEL.

Sheet bars, from which black plate (the raw material of tin plate) is rolled, were selling in England just before the war at about the same price which they commanded in the United States.[1] In 1909 and the first half of 1910 the cost of sheet bars at mill in the United States was approximately $27.50 per ton of 2,000 pounds, and in Wales $21.50. During 1911 and the greater part of 1912 the price of sheet bars in the United States was materially lower.

During this period the English producer had no advantage over the American producer in the cost of sheet bars.[2]

In his testimony in 1913, before the Ways and Means Committee of the House of Representatives, Mr. E. R. Crawford, president of the McKeesport Tin Plate Co., stated that the cost of sheet bars to tin-plate producers in the United States and in England were at that time about the same. He said, however, that it is safe to assume that normally the cost of sheet bars to the Welsh producer would be less than to the American producer. Industrial conditions, however, have much to do with the price variations in the two countries, and steel sells at higher or lower prices in the United States, as compared with foreign countries, according to trade developments. In the

[1] Tariff Hearings before Ways and Means Committee, 1913, pp. 1136-1140. See also quotations for United States in Iron Age, Jan. 3, 1918, p. 68. Prices in Iron Age are quoted by the pound and average for 1909 about $25.64, and $28.55 for the first 6 months of 1910, per ton of 2,000 pounds.

[2] Tariff Hearings, 1913, pp. 1136-1140.

lle nineties, when the United States was passing through one of verest industrial depressions, the price per ton of sheet bars was t $15.50, while in England it was $18.70, or about 20 per cent er. Under average conditions the American producer is not usly handicapped as compared with his English or Welsh com- or in the matter of steel prices.

LABOR COST.

e labor cost in the United States is materially higher than in the ed Kingdom, and this element is important, especially in the con- on of sheet bars into black plate. As was shown on pages 79–80, t 60 per cent of the cost of converting sheet bars into black plate, termined by the Commissioner of Corporations for the years -1906, was labor cost. While labor cost forms a much smaller rtion of the conversion cost involved in making tin plate out of plate, it is nevertheless an important element.[1] The principal vantage at which the American producer is placed compared his European competitor is his greater labor cost.

abulation enumerating the elements entering into the labor cost ving the production of tin plate and comparing these cost nts in Wales and the United States was made by the representa- of 12 independent companies in the United States at the time ariff of 1909 was under discussion. According to Mr. E. R. ford, of the McKeesport Tin Plate Co., these costs were practi- the same in 1913 as in 1909. These elements and the amounts ing into the production of a gross ton of tin plate were computed lows: [2]

Item.	Cost per gross ton.		Item.	Cost per gross ton.	
	United States.	Wales.		United States.	Wales.
ing	$9.76	$4.555	Washing		$1.245
	.425	.305	Rising	$0.88	.466
	.485	.275	Assorting	.32	.415
g	.87	.666	Boxing	.375	.20
ing	.525	.20	General tin house	1.745	1.22
mill	3.325	1.66			
ealing	.375	.278	Total labor cost	20.410	12.73
	1.325	1.245			

e above computation purports to be based upon wage scales of malgamated Association of Iron, Steel, and Tin Workers and Plate Workers' International Protective Association of America, e United States, and the wage scales of the Tin Plate Section, , Wharf, Riverside, and General Workers' Union of Great in and Ireland, for Wales.

e above figures would indicate that the most serious handicap e American producer is the difference in labor cost, a difference favors the British producer very materially.

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mputing the proportion of labor entering into the cost of manufacture, it must be remembered r has already entered into the production of the material in its anterior stages. Thus in the case ate a big item in the cost of manufacture is the cost of pig tin, in the production of which labor ved. To determine how much of the price paid for a finished commodity represents labor cost ost all stages of manufacture is practically impossible. It would, of course, be large. The labor ssed above is simply the labor cost for the particular stage or stages of manufacture discussed.

[2] Hearings before the Committee on Ways and Means, 60th Cong., Vol. VII, p. 7921.

	United States.	Wales.
.....	$850,000	$416,000
d finished material, accounts receivable, etc.....	800,000	320,000
	1,650,000	736,000

ng to this calculation, the investment required in the United equip and maintain in running order a plant capable of pro- ,500 tons of tin plate a year was $914,000 greater than in At 6 per cent interest this would be equivalent to a difference interest charges of $54,840.

ditional cost per ton of output would be $1.68, which is t to 8 cents per 100 pounds. In addition to this greater cost nerican producer compared with the producer in the United was the annual charge for repairs and upkeep of the plant, s estimated in the testimony before the Ways and Means e bo be $25,000 more for the producer in the United States the manufacturer in Wales. The additional cost for the producer would be about 3.4 cents [1] per 100 pounds. the 8 cents already given the American manufacturer handicapped by higher investment costs than his British r by an amount equivalent to 11 to 12 cents per 100 pounds

RELATIVE COSTS IN GENERAL.

espect to the five elements entering into the cost of pro- the American producer is apparently at no serious dis- e with respect to the prices of pig tin and steel bars. It is estion how far figures given with reference to investment accurate or typical, and how far they should be considered timate of costs. Labor, however, seems to be higher per utput in the United States than in the United Kingdom. n of wages based upon piecework show a higher scale of tion in the United States than in Wales. When the tariff which gave the tin-plate industry its first great start in the tates, was enacted, and several years later, the wages per n-plate mills in this country were double those in the United . According to Sir R. Giffen, the Welsh laborer received erage in 1897, $5.46 (£1 2s. 5d.) per week, while the Penn- workman, whose efficiency at that time was no greater, $10.68 per week. The figures cited above as representing ts in 1909 and 1913 show a similar difference between the tries.

st of transporting tin plate from interior mills to the sea- re the consumption is greater is a factor of importance in eting of plate. In prewar times the Welsh producers had ntage of low ocean freight rates.

BOUNTIES ON EXPORTS.

ctor does not play as big a rôle in the competition between and foreign producers as it does in steel rails and other Before the war, Germany gave the same indirect boun-

[1] ings the additional cost is estimated at 5 cents. On the basis, however, of an annual output ons, the additional cost would figure out about 3.4 cents per 100 pounds.

ties on export tin plate in the form of reduced freights to the e and lower prices for raw material that she gave to rail manufactu (See survey on Steel Rails, c-6 p. 26.) While Germany at the be ning of the war was the third greatest producer of tin plate in world, she was, however, far behind the United States and Engl

EXPORT TIN PLATE AND WAGES.

In a letter dated December 8, 1908, and addressed to the Commi on Ways and Means of the Sixtieth Congress, James Kenned Member of Congress from Ohio, stated that he had been infor that tin-plate workers in their annual contract with their emplo were obliged to agree to throw off 25 per cent of their wages w manufacturing tin plate for export. In a letter dated Januar 1909, the Amalgamated Association of Iron, Steel, and Tin Wor asked for the abrogation of the drawback allowed on reexported plate and the maintenance of the duty on tin plate. It was conten that in order to compete with imported tin plate destined for export, American workmen were obliged to take a reduction o per cent in wages when working on export plate. American m were being closed in many instances on account of Americans u foreign plate in their export trade. The manufacturer in the Un States in order to meet this competition was obliged to reduce w on the exported product.[1]

This arrangement with regard to a 25 per cent reduction in w when work was done in the manufacture of tin plate destined export was due to an agreement between the Amalgamated Asso tion and the American Sheet & Tin Plate Co. which was in effec 1903. This special arrangement between employers and emplo has not been in force since the year 1909.[2]

IMPORTS AND PRODUCTION OF TIN PLATES AND TERNEPLATES, 1 1918.

The establishment of the tin-plate industry in the United Stat usually dated from the enactment of the tariff of 1890, the provis of which with reference to tin plate went into effect July 1, 1891. effect on importation and home production was almost immedi While the duties of later tariff acts were lower than that fixed in act of 1890, they were high enough to enable the American prod to gain and hold the American market. The effect of the law of 1 and later tariffs on importations and domestic production ma shown in the following tabulation:[3]

[1] Tariff hearings before Committee on Ways and Means, 60th Cong., pp. 7417-7418, and 7426.
[2] Letter signed by John Williams, president of the Amalgamated Association of Iron, Steel, a Workers, dated July 24, 1918.
[3] Statistical abstract 1916, p. 715.

Tin Plates.

Years.	Imports (by fiscal years).	Production (by calendar years).	Years.	Imports (by fiscal years).	Production (by calendar years).
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
[illegible]	572,252,699	.....	1903	109,913,293	1,075,200,000
[illegible]	572,220,397	.....	1904	126,909,360	1,026,384,851
[illegible]	634,944,945	.....	1905	161,066,820	1,105,440,000
[illegible]	735,779,988	.....	1906	120,819,732	1,293,740,000
[illegible]	680,060,925	.....	1907	142,529,406	1,153,097,000
[illegible]	1,036,489,074	[1] 2,236,743	1908	140,739,972	1,203,075,000
[illegible]	422,176,202	[2] 42,119,192	1909	117,312,174	[5] 1,370,788,000
[illegible]	628,425,902	123,606,707	1910	154,566,599	1,619,005,000
[illegible]	454,160,826	[3] 166,343,409	1911	95,319,730	1,756,070,000
[illegible]	508,038,938	254,611,395	1912	6,613,253	2,157,055,000
[illegible]	385,138,983	359,209,798	1913	28,344,243	[6] 1,845,130,000
[illegible]	230,073,683	[4] 574,779,520	1914	48,877,947	2,085,980,000
[illegible]	171,662,345	732,289,600	1915	10,642,237	2,365,295,700
[illegible]	108,484,826	808,360,000	1916	1,796,853	2,766,401,227
[illegible]	147,963,804	850,004,495	1917	1,370,462	3,387,206,564
[illegible]	117,380,312	894,411,840	1918	71,403	3,301,206,564
[illegible]	198,996,086	806,400,000			

[1] Half year.
[2] First year after the act of 1890 went into effect.
[3] Tariff act of 1894.
[4] Tariff act of 1897.
[5] Tariff act of 1909.
[6] Tariff act of 1913.

After 1898 imported plate was largely reexported, the American producer having nearly full control of the home market.

Production of iron and steel terneplates and steel tin plates in the United States.[1]

Years.	Terneplates.			Steel tin plates.	Grand total.
	Iron.	Steel.	Total.		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
[illegible]	5,765,000	162,419,000	168,184,000	1,450,821,000	1,619,005,000
[illegible]	7,720,000	150,721,000	158,441,000	1,597,629,000	1,756,070,000
[illegible]	11,259,000	180,137,000	191,396,000	1,965,659,000	2,157,055,000
[illegible]	6,433,000	130,511,000	136,944,000	1,708,186,000	1,845,130,000
[illegible]	6,109,000	140,086,000	146,195,000	1,939,785,000	2,085,980,000
[illegible]	4,653,860	158,816,786	163,470,646	2,201,825,054	2,365,295,700
[illegible]	4,199,154	209,977,798	214,176,952	2,552,224,275	2,766,401,227
[illegible]	1,188,660	152,702,993	153,891,653	3,233,314,911	3,387,206,564
[illegible]	.....	85,376,569	85,376,569	3,216,247,675	3,301,624,244
[illegible]	322,330	170,532,400	170,854,730	2,407,156,757	2,578,011,487

[1] Annual Report of American Iron and Steel Institute.

NOTE.—The figures for steel tin plates of the year 1913 include 1,000 pounds of iron tin plate and those for 1916, 208,000 pounds of iron tin plate.

The above figures show the realtive importance of tin plate and terneplate with reference to the amounts produced. They also show the relative importance of steel and iron terneplates.

PRODUCTION OF COKE AND CHARCOAL TIN PLATES IN THE UNITED STATES, 1913–1919.

The terms "coke" and "charcoal" when applied to tin plates, as has already been pointed out, have no special significance except with reference to the thickness of the coating of tin on the plate, charcoal tin plate being more heavily coated with tin than coke tin plate. The relative amounts of coke and charcoal tin plates produced in the United States are shown as follows:[1]

Years.	Coke tin plates.	Charcoal tin plates.	Total tin plates.
	Pounds.	*Pounds.*	*Pounds.*
[illegible]	1,662,148,000	46,038,000	1,708,186,000
[illegible]	1,896,736,000	43,049,000	1,939,785,000
[illegible]	2,158,652,378	43,172,676	2,201,825,054
[illegible]	2,494,648,296	57,575,979	2,552,224,275
[illegible]	3,166,716,865	66,598,046	3,233,314,911
[illegible]	3,163,286,464	52,961,211	3,216,247,675
[illegible]	2,362,509,605	44,647,152	2,407,156,757

[1] Figures taken from annual reports of the American Iron and Steel Institute for 1913–1916.

APPROXIMATE CONSUMPTION OF TIN PLATES AND TERNEPLATI

For a number of years after the tin-plate industry had be firmly established in the United States, our consumption of tin terne plates was greater than our production. In late years, ever, our production has exceeded our consumption. The fi for the years, 1907–1919 (calendar years), are as follows:[1]

Years.	Production.	Add imports.	Deduct exports.	Ap ma sum
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gro*
1907	514,775	57,773	10,203	
1908	537,087	58,490	11,878	
1909	611,959	62,593	9,327	
1910	722,770	66,640	12,445	
1911	783,960	14,099	61,381	
1912	962,971	2,052	81,694	
1913	823,719	20,680	57,812	
1914	931,241	15,411	59,549	
1915	1,055,936	2,350	154,642	
1916	1,235,000	1,008	227,391	1,
1917	1,512,146	124	232,799	1,
1918	1,473,939	33	258,538	1,
1919	1,150,898	242	204,521	

Exports of tin plates (including black plates and tin sheets) from the United Ki for the calendar years 1912–1916.[2]

Exported to—	1912	1913	1914	1915	1
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Lon*
Argentina	10,283	19,323	7,789	10,588	
Australia	33,308	33,202	35,804	46,441	
Belgium	18,875	13,363	8,744	.....	.....
Brazil	9,721	14,414	6,358	6,113	.....
British East India	53,612	68,276	69,544	46,729	
Canada	7,297	9,899	8,246	2,664	
China and Hongkong	15,406	21,691	21,847	9,253	
Denmark	6,384	5,312	5,815	6,109	.....
Dutch East Indies	9,503	16,100	16,736	16,074	.....
France	31,930	21,332	27,739	50,744	
Germany	41,379	34,739	17,910	.....	.....
Italy	21,478	20,418	16,250	19,510	
Japan	23,236	28,222	28,166	20,550	
Netherlands	44,156	43,009	30,765	27,908	
Norway	31,503	25,166	28,900	38,510	
Portugal	15,797	14,873	10,983	15,831	
Roumania	35,920	10,927	17,512	1,181	
Russia	9,675	9,921	8,956	2,313	
Sweden	7,264	7,660	5,613	5,274	.....
United States	2,135	21,516	17,468	1,014	
All other countries	52,261	55,144	46,247	32,972	
Total	481,123	494,497	435,392	368,778	
Total value for years 1914–1916	.....	.....	$25,194,546	$27,651,211	$41,

TIN PLATE AS A "TONNAGE PRODUCT."

While tin plate is spoken of in the parlance of the steel tra having become a "tonnage product," it is, as a matter of fact sold by weight, invoices being in base boxes, a base box conta 31,360 square inches, the area of a box of 112 sheets each 14 1 inches in size. The production in round numbers for the year was 33,000,000 base boxes, which would amount in weight to 1,500,000 tons. While the tonnage is impressive, the area is still so for 33,000,000 base boxes means almost precisely 164,750 Roughly speaking, 2½ base boxes of tin plate are required to

[1] Annual report of the American Iron and Steel Institute.
[2] *Supplements* to Commerce Reports No. 19–c, Nov. 7, 1917, pp. 14–15, and No. 19–b, Nov. 1, 32–33.

1,000 2-pound cans. The 1918 output, therefore, if made into 2-pound cans, would make about 13,200,000,000 cans, or 150 cans per capita of population. The amount actually used in packing the perishable food crops is less than half the total supply, some portion of the remainder being used in packing other foods, including condensed milk, for which the war requirements were extremely heavy.[1]

Production of tin plates and terneplates by the United States Steel Corporation and independents.[1]

Years.	Production of United States Steel Corporation.	Production of independents.	Total production.	Percentage of the United States Steel Corporation.
	Gross tons.	*Gross tons.*	*Gross tons.*	
1902	264,109	95,891	360,000	64.9
1910	440,694	282,076	722,770	61.0
1911	476,036	307,924	783,960	60.7
1912	581,346	381,625	962,971	60.37
1913	483,002	340,717	823,719	58.64
1914	498,863	432,378	931,241	53.57
1915	509,879	486,057	1,005,936	53.97
1916	620,732	614,268	1,235,000	50.26
1917	735,571	776,575	1,512,146	48.64
1918	711,985	761,954	1,473,939	48.30
1919	557,468	593,430	1,150,898	48.44

[1] Annual Reports of the American Iron and Steel Association and the American Iron and Steel Institute.

WAR PRICES AND PRICE REGULATION IN GREAT BRITAIN AND THE UNITED STATES.

As shown in the quotations on page 88, the prices of tin plate showed a marked tendency to rise in 1916. The maximum was reached in July, 1917, when a base box of coke tin plate, 112 sheets, weighing 100 pounds, Pittsburgh, Pa., was quoted at $12. The same quotation, after a slight reduction in August, obtained in September. During November and December the maximum price was fixed at $7.75, where it remained up to the time of the armistice. The price of terneplate was a little lower—in 1918 $7.65—a price "ad justed" by the steel makers.

In 1916 the prices of tin plate averaged much higher in England than in the United States. For I C coke, 14 by 20, 112 sheets, the mill price in England varied from $9 in May and June to $5.83 in October. The closing quotation of the year was $6.81. These prices were Government certificate prices. The Government was a large purchaser of tin plates, and for all orders for supplies it issued to the workers what are known in the trade as "class A" and "class B" certificates, under which works were entitled to obtain the necessary quantities of sheet bars and acid for the execution of their orders. There was much competition between makers for these certificates, which meant securing raw materials to keep their mills going. This competition so affected prices that orders were at one time booked for "commons" as low as $5.83 per box. Later, makers decided to pool Government orders, with the result of an increase to $6.81 at

[1] Iron Age, June 27, 1918, p. 1584.

the close of the year. For supplies outside of these Government certificates, prices were maintained at a higher level, averaging about $8.27 per box during the last quarter of 1916. Since tin-plate works were placed under the control of the Government two distinct prices were quoted, those for filling directly or indirectly Government contracts and those for ordinary home or export trade.[1]

In 1917 in Great Britain prices fluctuated between 27s. ($6.57) and 37s. 6d. ($9.12) per box of 112 sheets of commons (I C 14-inch) f. o. b. railway at factory. In August by Government regulation the maximum price was fixed at 30s. ($7.30), based on the cost of tin at £240 ($1,168) per ton. This price was made subject to an increase of 3 cents per box for each advance of £5 ($24.33) in the price of tin. The price of terneplates was fixed at 28s. ($6.81) per box with tin at £240 ($1,168) per ton, subject to a rise of 3 cents per box for each advance of £20 ($97.33) per ton in the price of tin.[2]

WAGES OF TIN-PLATE WORKERS IN THE UNITED KINGDOM.

Efforts to increase the output of tin plate in Great Britain were shown in the granting in October, 1917, of bonuses to workers varying from 40 per cent to 72 per cent of their weekly earnings. The weekly earnings with bonuses are shown in the tabulation below:[2]

Weekly earnings.	Bonus per-centage.	Bonus.	Total.
Up to $4.87	52½	Up to $2.55	Up to $7.42
$4.88 to 7.30	72½	$3.53 to 5.29	$8.41 to 12.59
7.31 to 9.73	67½	4.93 to 6.56	12.24 to 16.29
9.74 to 12.16	62½	6.08 to 7.60	15.82 to 19.76
12.17 to 14.60	60½	7.36 to 8.83	19.53 to 23.43
14.61 to 17.04	50	7.30 to 8.52	21.91 to 25.56
17.05 to 24.33	42½	7.24 to 10.34	24.29 to 34.67
24.33 and up.	40	9.73 and up.	34.06 and up.

No figures or estimates were given in the Commerce Report from which the above schedule of wages and bonuses was taken concerning the number of workers on these different wage levels.

TIN CONSTRUCTION IN THE UNITED STATES IN 1917.

According to a statement compiled by the War Industries Board from returns obtained through the subcommittee on pig tin, the consumption of pig tin in the United States for different purposes in 1917 was as follows in gross tons:

Tin and terne plate	27,600	Collapsible tubes	2,100
Solder	17,000	White metal	1,764
Babbitt and other metals	10,800	Miscellaneous	8,193
Brass and bronze	4,800		
Foil	4,000	Total	76,257

According to the above a little over one-third of the tin consumed in the United States is used in the manufacture of tin plate and terneplate.

[1] Supplement to Commerce Report, No. 19-c, Nov. 7, 1917, p. 16.
[2] Supplement to Commerce Report, No. 19-e, May 20, 1918, pp. 14-16.

GALVANIZED SHEETS.

Summary.

Galvanized sheets are iron and steel sheets coated with zinc ("spelter") to protect them from corrosion, and are used for roofing, buckets, and other articles. Galvanized sheets are classified according to thickness, the standard grade being No. 28 wire gauge (one-sixty-fourth inch thick). Corrugated sheets are also given a separate classification from plain galvanized sheets.

The United States is the leading producer of galvanized sheets, the output in 1919 being 1,641,070,432 pounds (732,620.7 long tons). England is the next largest producer, and during the prewar period was the world's greatest exporter. In 1913 the exports of galvanized sheets in England amounted to 762,075 gross tons, or 1,707,049,000 pounds. The exports of England represent about 80 to 90 per cent of her output. During the war England's production of galvanized sheets declined greatly, and in 1918 amounted to only 47,377 tons.

The imports of galvanized sheets form an insignificant fraction of the country's consumption. The ratio of imports to domestic output has for the past seven or eight years (1913, fiscal year, to 1919, calendar year) been about one one-hundredth of 1 per cent or less. Exports during the same period have ranged from 6 to 15 per cent of the domestic output.

The most important items in the expense of the manufacture of galvanized sheets are the costs of black sheets and spelter. The former constitutes from two-thirds to three-fourths of the total expense of manufacture. Over half of the remaining cost is that of spelter. With reference to both these items manufacturers in this country are as favorably situated as those of any other country. The prices of black sheets and spelter are as low here as in any other country. Labor cost constitutes only about 3 or 4 per cent of the total expense of manufacture.

With reference to competitive conditions, there is no tariff problem involved in the manufacture of galvanized sheets in the United States. The prices and costs of these articles are as low here as in any other part of the world. An insignificant percentage of the domestic consumption will probably continue to be imported.

An import duty on this material will yield only a small amount of revenue. If an ad valorem rate is imposed, no serious problem with respect to classification is raised. In the case of specific rates a classification of sheets would be necessary. For ordinary flat sheets the galvanized product should be divided into classes according to thickness. Corrugated sheets or sheets rolled in grooves should be separately classified.

Galvanized sheets—Summary table.

	Domestic[1] production.	Imports for consumption.	Domestic exports.	Ratio to production.	
				Imports.	Exports.
Fiscal year—	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1910		67,867			
1911		64,027			
1912		18,321			
1913	1,975,053,845	261,459	256,816,536	0.01	13.0
1914	1,939,270,738	163,593	120,377,252	.01	6.2
1915	1,693,761,996	102,667	123,099,461	.01	7.3
1916	1,477,227,145	112,945	177,414,298	.01	12.0
1917	1,388,880,976	26,192	203,476,300		14.6
1918	1,280,889,074	154,675	178,393,464	.01	13.9
1919	1,641,070,432	17,041	192,896,307		11.7
Calendar year—					
1919	1,641,070,432	127,196	227,669,237	.01	13.8

	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
Fiscal year—				*Per cent.*
1910	$3,090.00	$1,062.25	$0.046	34.3
1911	1,775.66	600.93	.028	33.8
1912	1,757.00	563.75	.096	32.0
1913	8,647.76	3,185.31	.033	36.8
1914	6,173.68	935.24	.038	15.1
1915	5,010.00	751.95	.049	15.0
1916	4,256.00	638.40	.038	15.0
1917	2,539.00	380.85	.097	15.0
1918	53,123.00	7,968.45	.343	15.0
1919	5,769.00	865.35	.339	15.0
Calendar year—				
1919	28,521.00	4,278.15	.224	15.0

[1] Calendar year.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

109. All iron or steel sheets, plates, or strips, and all hoop, band, or scroll iron or steel, when galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals, 15 per cent ad valorem.

DESCRIPTION.

Galvanized sheets are iron and steel sheets coated with zinc or spelter to protect them from corrosion. They are employed chiefly for roofing, buckets, and other articles which are subjected to atmospheric influences. Like black sheets (see Survey on Iron and Steel Sheets), the galvanized product is classified according to thickness, No. 28 wire gauge (one-sixty-fourth inch thick) being standard.

Tariff classifications.—In the tariffs of 1897 and 1909, in which specific rates were imposed, galvanized sheets were classified according to wire gauges into the following divisions: (1) Thinner than No. 10 but not thinner than No. 20; (2) thinner than No. 20 but not thinner than No. 25; (3) thinner than No. 25, but not thinner than No. 32; and (4) thinner than No. 32. The rates in these acts were a two-tenths cent per pound above those for the gauges mentioned when not galvanized or coated. In addition to this grading, which applied to ordinary sheets, those which were corrugated and crimped were given a separate classification.

In the tariff of 1913 an ad valorem rate of 15 per cent is imposed upon all galvanized sheets and plates. In the reports of the Bureau of Foreign and Domestic Commerce, galvanized sheets and plates are divided according to the steel used in manufacture, as follows:

(1) Boiler or other plate iron or steel, except crucible plate steel and saw plate, and galvanized corrugated or crimped sheets.

(2) Sheets and plates not sheared or rolled in grooves.

(3) Sheets and plates (except saw plates) when made by the Bessemer, Siemens-Martin, open-hearth, or similar process, not containing alloys such as nickel, cobalt, etc.

(4) Sheets and plates when made by the crucible, electric, or cementation process, either with or without alloys and finished by rolling, hammering, or otherwise.

DOMESTIC PRODUCTION.

The United States leads all other countries of the world in the manufacture of galvanized sheets. In 1919 the country's output amounted to 1,641,070,432 pounds (732,620.7 long tons).

Raw material.—The raw materials of galvanized sheets consist principally of iron and steel sheets, which have been carefully cleaned and pickled, and zinc, the commercial grades of which are known as spelter. These materials are of domestic origin. In addition to these materials acids are used in pickling and cleaning. Flux and fuel, which are also employed in furnace operation, and the acid constitute a small fraction of the raw material cost.

Equipment and method of production.—In the manufacture of galvanized sheets equipment for pickling include vats containing acid and water. The material used for coating is placed in a steel tank approximately 4 feet deep and 7 feet square and kept in a molten state. The sheets are first pickled and cleansed with acid and water to remove scale. After a second cleansing in a tank containing a weak solution of hydrochloric acid one sheet at a time is withdrawn and passed between rubber rolls, which squeeze off the diluted acid solution and direct the sheet into a box containing a mixture of sal ammoniac and tallow, which acts as a flux. The sheet then passes between another pair of rolls and by means of guides is fed into the bath of spelter, where it is gripped by a third pair of rolls located near the bottom of the spelter bath. Further guides direct the sheets upward into another set of rolls, which squeezes off the excess spelter and delivers the finished product on a chain conveyor.

The production process is, in the main, a machine affair. In the cleansing and pickling processes, however, the amount of labor employed is appreciable.

Organization.—The manufacture of galvanized sheets is generally accomplished by the same business organizations as produce the sheets themselves. A large percentage of the country's output is made in the mills of the United States Steel Corporation and other large steel companies.

Geographical distribution.—Galvanized sheets are produced for the most part in the northeastern part of the country, in the States extending from Pennsylvania and New York west to and including Missouri. Ohio and Pennsylvania are the leading States. According to the census of 1914, over half the country's output was produced in the first of these two States.

Domestic production and consumption.—The country's output of galvanized sheets exceeds its consumption. In the calendar year 1919 the domestic production amounted to 1,641,070,432 pounds. Of this total 227,669,237 pounds were exported. Only 127,106 pounds of galvanized sheets were imported. The approximate consumption in 1919 was thus 1,413,528,391 pounds, or over 200,000,000 pounds less than the country's output. During the past six or seven years, while exports ranged from 6 to 14 per cent of the country's output, imports constituted but a small fraction of 1 per cent of the total consumption.

The production of galvanized sheets in 1913 amounted to 1,973,053,845 pounds. The consumption amounted to 1,718,498,768 pounds, or over 250,000,000 pounds less than the country's output. During the war the production and consumption of galvanized sheets declined some 30 or 35 per cent, but increased again after the armistice.

Domestic exports.—During the years from 1913 to 1919, inclusive, exports have ranged from 120,377,252 pounds in the fiscal year of 1914 to 256,816,536 pounds in 1913. In the calendar year 1919 they amounted to 227,669,237 pounds, valued at $15,223,289. Over one-fourth of the exports went to Canada and Australia, and about two-thirds to Cuba, Argentina, the Philippines, and Japan. In 1913 the exports aggregated 256,816,536 pounds, valued at $7,652,956, of which 83,011,277 pounds, valued at $2,428,687, or about one-third of the total, went to Canada. Other important countries receiving exports from this country that year were Mexico, Cuba, Argentina, Chile, Japan, Australia, and the Philippine Islands.

FOREIGN PRODUCTION.

Great Britain ranks next to the United States as the greatest producer of galvanized sheets. In 1915 England's output amounted to 351,593 gross tons, or 787,567,320 pounds. This output represents a marked reduction from the prewar production. In 1913 the exports of galvanized sheets amounted to 762,075 gross tons, or 1,707,049,000 pounds.[1] As 80 to 90 per cent of the country's output was exported, these figures give some indication of the country's production.

During the war England's production of galvanized sheets declined. In 1918 it was less than one-seventh of what it was in 1915, and in 1915 less than one-half of the exports alone. One reason for this decline was the falling off in the export trade and the strict control exercised over the industry within the Kingdom throughout the war period. A large percentage of the mills were occupied in the manufacture of black and painted sheets, especially those required for war purposes, like trench plates, etc. Another reason was the shortage of steel bars and labor, and a third, the high price of spelter which rose from the prewar level of £23 per ton to £55 per ton in 1917.

IMPORTS.

Imports form a small fraction of the total amount of galvanized sheets consumed in this country and show no marked tendency to increase. They averaged more in the three years 1907 to 1909,

[1] *National Federation of Iron and Steel Manufacturers, Statistical report, 1918, pp. 6 and 9.*

inclusive, than in any consecutive three years since that time. During the fiscal years 1907 to 1919, inclusive, imports ranged from 359,730 pounds in 1907 to 17,041 pounds for the fiscal year 1919. While the imports for the fiscal year 1919 aggregated less than in any year during the 13 years mentioned, they increased greatly during the latter half of 1919, amounting for the calendar year to 127,196 pounds, as against 17,041 pounds for the fiscal year. Over half of the imports for 1919 consisted of sheets and plates made by the Bessemer and open-hearth process, not containing alloys such as nickel, cobalt, vanadium, etc. About half of the remainder were galvanized sheets of iron or steel, common or black, and skelp iron or steel, not sheared or rolled in grooves.

PRICES.

The price of galvanized sheets in the United States is quoted by the pound, with No. 28 wire gauge as a standard and Pittsburgh, Pa., as a base. During the decade preceding the outbreak of the war in 1914 the Pittsburgh price for the standard grade galvanized sheet ranged from $0.0375 per pound in the spring and summer of 1907 to $0.0275 in June and July, 1914. During the period of high prices prevailing in 1899 and 1900 the maximum was reached in August, 1899, when $0.0485 per pound was quoted.

After the outbreak of the World War prices began to rise, slowly at first, but rapidly late in 1916 and the first half of 1917. In July and August of the latter year the quotation was $0.10 per pound. Late in 1917 and during practically the whole of 1918 the price of standard galvanized sheets was fixed under governmental supervision at $0.0625 per pound. In 1919 it fell to $0.057, but rose again to $0.09 in August and September, 1920. By the end of November the price had fallen again to $0.06 per pound.

Selling prices in England exhibit about the same general trend as in this country. They have ranged somewhat higher since the close of the war.

TARIFF HISTORY.

Before the act of 1913 galvanized sheets were subject to specific duties. Specific rates were imposed upon common iron or steel sheets graduated according to gauge or value and an additional duty was placed upon the galvanized coating. In the act of 1883 the rates on boiler or other plate, sheared or unsheared, skelp, sheet iron, common or black, ranged from 1.1 cents per pound to 1.5 cents per pound for all sheets and plates not thinner than No. 29 wire gauge, and 30 per cent ad valorem for sheets thinner than No. 29 wire gauge. The galvanized product paid ½ cent per pound additional.

In the act of 1890 the rates on common sheets and plates and skelp valued at 3 cents per pound or less bore duties ranging from 1 cent per pound to 1.4 cents per pound, the galvanized product carrying ½ cent per pound additional. The tariff of 1894 reduced these rates to 0.7 cent to 1.1 cents per pound plus ¼ cent for the galvanized product. The act of 1897 retained the rates of the act of 1894 for common or black sheets thinner than No. 10 wire gauge, but not thinner than No. 32 wire gauge. For sheets

thinner than No. 32 wire gauge a rate of 1.2 cents per pound w imposed. The galvanized product had an additional rate of 0.2 c per pound.

In the act of 1909 the rates on common or black sheets were reduce to 0.5 cent per pound on those thinner than No. 10 wire gauge, b not thinner than No. 20 wire gauge to 0.9 cent for those thinner th No. 32 wire gauge. A duty of 0.8 cent per pound was placed o corrugated or crimped sheets and an ad valorem rate of 30 per ce on all the foregoing sheets when valued at more than 3 cents p pound. The galvanized product paid the same additional dut in the act of 1897.

In 1913 an ad valorem rate of 15 per cent was imposed upon a galvanized iron and steel sheets, plates, strips, etc.

COMPETITIVE CONDITIONS.

In the manufacture of galvanized sheets the cost of black sheet constitutes from 65 to 75 per cent of the total manufacturing expense. The next most important item is the charge for spelter, which range from about 15 to nearly 25 per cent of the total. The direct labo cost amounts to only about 2 to 4 per cent.

The only country with which the United States has any compe tition is Great Britain. In 1918 Clement F. Poppleton made a com parison of American and English costs in the Iron Age.[1] The English costs are for corrugated sheets No. 24 B. W. G. per ton of 2,240 pounds, as follows:

	£	s.	d.
Black sheets, 2,114 pounds, at £6	5	13	3
Spelter, 182 pounds, at £24	1	19	0
Hydrochloric acid, 2 cwt., at 1s. 5d		2	10
Vitriol, 0.5 cwt., at 2s		1	0
Coke for firing pot and drying furnaces		1	0
Coal for boilers, including light		1	0
Muriate of ammonia (flux), 11 pounds, at 2.75d		2	7
Loss on dross		1	6
Loss on wasters (2 per cent of sheets at £2 a ton)			9
Labor:			
Galvanizing and pickling		3	0
Coking and cleaning (£4 5s. a week)			4
Corrugating			10
Packing and warehousing		1	6
General charges distributed		1	9
Interest on capital (5 per cent annually on £9,000)			1
Depreciation on fixed plant and buildings [2]			0.5
Other charges			1.5
Renewals of wearing parts of gear			2
Light (wages, carbon, etc., £4 5s. a week)			4
Oil and stores			2
Freight to Liverpool (estimated)		1	8
	8	13	10

Or $41.48 per ton of 2,240 pounds.

The American costs for galvanized corrugated sheets, 24-gauge, were as follows:

Black sheets, 1,850 pounds, at $43.10	$39.8
Spelter, 200 pounds, at $0.065	13.0
Acid, 120 pounds, at $0.005	.6
Fuel for firing pots	.2
Power	.5

[1] *Iron Age*, Aug. 22, 1918, pp 435-436.

[2] Five per cent per annum on £4,000.

Muriate of ammonia (flux), 12 pounds, at $0.05	$0.60
Loss on dross	.40
Loss on wasters, 2 per cent of sheets	.20
Labor:	
Galvanizing	.50
Pickling	.35
Fireman	.10
Corrugating	.25
Packing and warehouse	.10
Warehouse clerical	.80
Weighing	.10
Repairs, labor	.20
Renewals:	
Machines	.20
Rolls, collars, and gears	.10
Light	.10
Oil and stores	.10
Timekeeper and watchman	.05
Overhead, including interest and depreciation	1.00
Total	59.36

The above costs are not entirely comparable, as war conditions with the price regulation then obtaining in England and the United States differed. Price regulation began in the former country before it began in this country and when the price of black sheets was lower than it was after the United States began its price regulation in 1917.

A revised cost estimate upon the basis of the prices of black sheets and spelter prevailing in the two countries in May, 1920, with an arbitrary 50 per cent increase for other items in the figures of Popleton show the following:

Estimated costs of producing galvanized corrugated sheets in Great Britain and the United States.[1]

[In dollars per ton of 2,000 pounds; exchange at $4.]

	British.			American.		
	Pounds.	Price.[2]	Cost.	Pounds.	Price.[2]	Cost.
		£ s.				
Black sheets	1,888	44 10	$150.03	1,850	$5.00	$92.50
Spelter	162	44 15	12.92	200	7.75	15.50
Acids	250	.....	2.00	120	.....	1.50
Flux	10	105 0	1.97	12	14.00	1.68
Zinc loss	(3)	(3)	.45	(3)	(3)	.50
Wasters	(3)	(3)	1.00	(3)	(3)	1.00
Total raw material	.....	.....	168.27	.....	.....	112.00
Labor (operating)	.....	.....	2.02	.....	.....	2.10
Labor (indirect)	.....	.....	.68	.....	.....	1.50
Repairs, etc	.....	.....	.10	.....	.....	.30
Fuel	.....	.....	.75	.....	.....	1.00
Other supplies	.....	.....	.15	.....	.....	.20
General charges	.....	.....	.10	.....	.....	1.00
Total cost	.....	.....	172.07	.....	.....	118.78
Selling price	.....	.....	200.00	.....	.....	120–160

[1] Report on British Investigation for U. S. Tariff Commission.—Paul M. Tyler.
[2] British prices in pounds sterling per ton of 2,240 pounds; American prices in dollars per 100 pounds.
[3] Estimated.

The above figures constitute simply an estimate based upon certain known items and probable costs as they were in the late spring of 1920. The known items—black sheets and spelter—embrace the items that make up about 90 per cent of the total expense of manufacture.

The prices of steel products were rising rapidly in England in the spring of 1920 and this rise probably accounts in large part for the great difference in English and American costs. This difference if continued would result in a decline of the British export trade in galvanized sheets and a probable great increase in the export trade of this country.[1] Costs in this country, however, have been appreciably lower during the last year than in England and will probably continue to be so for a long time to come.

During recent years the American manufacturer of galvanized sheets has had little to fear in the way of foreign competition. The cost of black sheets and spelter which constitutes the greater part of the expense of manufacture is less here than abroad. The insignificant amount of importation compared with exports and domestic production shows that the American producer is tolerably secure.

TARIFF PROBLEMS.

From a competitive standpoint there is no tariff problem involved in the manufacture of galvanized sheets in the United States. It is probable that there will continue to be a small importation of galvanized sheets. A low or moderate duty would serve to yield a very limited amount of revenue. If an ad valorem rate is imposed as in the present tariff no question arises with reference to classification. In the case of specific rates a graduated scale of duties would be advisable on account of the differences in value of the sheet steel used. A fair basis for such a scale in the case of common sheets would be gauge, the rates rising as the sheets become thinner. Corrugated sheets demand and generally receive a separate classification from plain sheets. When metal in the sheet is an alloy of iron or steel with some other metal, thus adding to the value of the sheet, special rates might be imposed on the basis of the value per pound of the sheet.

Galvanized plates or sheets—Production in United States.[a]

[From Federal Census.]

State.	1914		1909	
	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*	
Delaware	(b)	(b)	(b)	(b)
Illinois	(b)	(b)		
Indiana	(b)	(b)	(b)	(b)
Kentucky	(b)	(b)	(b)	(b)
Missouri	(b)	(b)		
New York	(b)	(b)		
Ohio	585,907	$21,364,731	191,986	$11,333,662
Pennsylvania	141,952	7,847,495	173,087	10,441,488
West Virginia	(b)	(b)		
All other	243,330	13,650,168	66,585	4,116,946
Total	971,189	42,862,394	431,658	25,912,096

[a] Not reported prior to 1909. [b] Included in "All other."

[1] The British galvanized sheet trade has now (January, 1921) been practically stagnant for several months.

Galvanized sheets—Production in United States.

[From American Iron and Steel Institute, 1918 and 1919.]

Year.	Galvanized sheets.	Galvanized formed products.[1]	Total.
	Pounds.	*Pounds.*	*Pounds.*
1913	1,845,864,365	129,189,480	1,975,053,845
1914	1,807,667,129	131,603,609	1,939,270,738
1915	1,581,569,206	112,192,790	1,693,761,996
1916	1,346,924,950	130,302,195	1,477,227,145
1917	1,273,978,805	114,902,171	1,388,880,976
1918	1,159,778,807	121,110,267	1,280,889,074
1919	1,500,575,548	140,494,884	1,641,070,432

[1] Articles formed or stamped from iron or steel black plates or black sheets and galvanized after the completion of the forming or stamping process.

Galvanized sheets—Production in principal foreign countries.[1]

UNITED KINGDOM.

	Tons.		Tons.
1915	351,593	1917	[2] 68,627
1916	131,707	1918	47,377

Galvanized sheets and plates—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1907		359,730	$12,031.10	$4,603.71	$0.033	38.27
1908		100,896	5,479.00	1,296.01	.054	23.65
1909		280,422	15,121.00	3,493.41	.054	23.10
1910		67,867	3,090.00	1,062.25	.046	34.38
1911		64,027	1,775.66	600.93	.028	33.84
1912		18,321	1,757.00	563.75	.096	32.09
1913		261,459	8,647.76	3,185.31	.033	36.83
1914		163,593	6,173.68	935.24	.038	15.15
1915		102,667	5,013.00	751.95	.049	15.00
1916		112,945	4,256.00	638.40	.038	15.00
1917		26,192	2,539.00	380.85	.097	15.00
1918		154,675	53,123.00	7,968.45	.343	15.00
1919		17,041	5,769.00	865.35	.339	15.00
Calendar year:						
1919		127,196	28,521.00	4,278.15	.224	15.00

Iron and steel, and manufactures of: Sheets or plates of iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers, tin), galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals, thinner than No. 10 and not thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1/5 cent per pound	12,611	$342.00	$113.50	$0.027	33.19
1908	....do....	11,000	339.00	99.00	.031	29.20
1909	....do....	37,757	1,173.00	339.81	.031	28.97

[1] Figures from National Federation of Iron and Steel Manufacturers Statistical Report, 1918, p. 6.
[2] Partly estimated.

Iron and steel, and manufactures of: Sheets or plates of iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers tin), galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals, thinner than No. 20 and not thinner than No. 25 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1897	1 cent per pound	7,456	$917.10	$74.56	$0.123	8.13
1898	do	2,512	349.00	25.12	.139	7.20
1899	do	641	104.00	6.41	.164	6.16

Iron and steel, and manufactures of: Sheets or plates of iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers tin), galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals—thinner than No. 25 and not thinner than No. 32 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1897	1½ cents per pound	219,709	$5,967.00	$2,856.22	$0.027	47.87
1898	do	44,506	3,553.00	578.58	.080	16.28
1899	do	189,439	12,153.00	2,345.71	.067	19.30

Iron and steel, and manufactures of: Sheets or plates or iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers tin), galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals—Thinner than No. 32 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1897	1½ cents per pound	25	$1.00	$0.35	$0.040	35.00
1898	do					
1899	do	892	99.00	12.35	.101	13.96

Iron and steel, and manufactures of: Sheet iron or sheet steel—Corrugated or crimped, galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals—Valued at 3 cents per pound or less—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1897	1¼ cents plus ⅖ cent per pound.	119,929	$4,804.00	$1,559.08	$0.040	32.45
1898	1⅖ cents per pound.	41,359	1,126.00	540.27	.027	47.96
1899	do	60,703	1,602.00	789.13	.026	49.26

Iron and steel, and manufactures of: Sheet iron or sheet steel—Corrugated or crimped, galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals—Valued above 3 cents per pound—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1908	$\frac{1}{5}$ cent per pound and 45 per cent	1,319	$112.00	$53.04	$0.085	47.36

Iron and steel, and manufactures of: Sheets of iron or steel, common or black, and skelp iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers tin), galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals—Valued at 3 cents per pound or less, thinner than No. 10 and not thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1911	$\frac{1}{5}$ cent per pound.	13,553	$391.00	$94.87	$0.029	24.26
1912	do.					
1913	do.	64	2.00	.45	.031	22.50
1914 [1]	do.	64	2.00	.45	.031	22.50

[1] July 1 to Oct. 3, 1913, under act of 1909.

Iron and steel, and manufactures of: Sheets of iron or steel, common or black, and skelp iron and steel (excepting what are commercially known as tin plates, terneplates, and taggers tin), galvanized or coated with zinc, spelter, or other metals, or any alloys of these metals—Valued at 3 cents per pound or less—Thinner than No. 20 and not thinner than No. 25 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1911	$\frac{1}{5}$ cent per pound.	420	$12.00	$3.36	$0.029	28.00
1912	do.					
1913	do.	13,033	324.76	104.26	.025	32.10

Iron and steel, and manufacturers: Sheets of iron or steel, common or black, and skelp iron or steel (excepting what are commercially known as tin plates, terneplates, and taggers' tin), galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals, valued at 3 cents per pound or less, thinner than No. 25 and not thinner than No. 32 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	1 cent per pound..	2,184	$65.00	$21.84	$0.030	33.60
1911	do	1,562	49.66	15.62	.032	31.45
1912	do					
1913	do	9,970	292.00	99.70	.029	34.14

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Iron and steel, and manufactures of: Sheets of iron or steel, common or black, and iron or steel (excepting what are commercially known as tin plates, terneplates, and t tin), galvanized or coated with zinc, spelter, or other metals, or any alloys of these n valued at more than 3 cents per pound—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu comp ad va ra
		Pounds.				*Per*
1910 [1]	1/8 cent per pound and 30 per cent.	36,722	$1,977.00	$666.54	$0.054	
1911	....do	400	17.00	5.90	.043	
1912	....do	17,963	1,738.00	557.33	.097	
1913	....do	12,415	1,022.00	331.43	.082	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Iron and steel, and manufactures of: Sheets of iron or steel, common or black, and iron or steel, corrugated or crimped, galvanized or coated with zinc, spelter, or metals, or any alloy of these metals, valued at 3 cents per pound or less—Import consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu comp ad val rat
		Pounds.				*Per*
1910 [1]	1 cent per pound	21,831	$577.00	$218.31	$0.027	
1911	....do	48,050	1,304.00	480.50	.027	
1912	....do					
1913	....do	110,552	2,630.00	1,105.52	.024	
1914 [2]	....do	300	5.00	3.00	.017	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909. [2] July 1 to Oct. 3, 1913, under act of 191

Iron and steel, and manufactures of: Sheets of iron or steel, common or black, and iron or steel, corrugated or crimped, galvanized or coated with zinc, spelter, or metals, or any alloy of these metals, valued at more than 3 cents per pound—Im for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu comp ad val rat
		Pounds.				*Per*
1910 [1]	1/8 cent per pound and 30 per cent.	7,130	$471.00	$155.56	$0.066	
1911	....do	42	2.00	.68	.048	
1912	....do	358	19.00	6.42	.053	
1913	....do	115,425	4,377.00	1,543.95	.038	
1914 [2]	....do	620	37.00	12.34	.060	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909. [2] July 1 to Oct. 3, 1913, under act of 1909.

Iron and steel, and manufactures of: Boiler or other plate, iron or steel (except cru plate steel and saw plates), and skelp iron or steel, sheared or rolled in grooves, galvan or coated with zinc, spelter, or other metals, or any alloy of these metals—Imports consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual comp ad valo rate
Fiscal year:		*Pounds.*				*Per ce*
1914 [1]	15 per cent	120	$27.00	$4.05	$0.064	1
1915	....do	2,691	132.00	19.80	.049	1
1916	....do	16,197	388.00	58.20	.024	1
1917	....do					
1918	....do	2,714	589.00	88.35	.217	1
1919	....do	1,419	175.00	26.25	.123	1
Calendar year:						
1919	....do	15,697	4,553.00	682.95	.29	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.

ıd steel, and manufactures of: Sheets of iron or steel, common or black, and skelp iron eel, not sheared or rolled in grooves—Galvanized or coated with zinc, spelter, or other ils, or any alloy of these metals (excepting what are known as tin plate, terneplates, and ers tin,—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
ear:		*Pounds.*				*Per cent.*
1[1]	15 per cent	138,807	$4,682.00	$702.30	$0.034	15
5	do	6,981	481.00	72.15	.069	15
6	do	47,371	2,077.00	311.55	.044	15
7	do	10,301	982.00	147.30	.095	15
8	do	1,136	220.00	33.00	.194	15
9	do	200	10.00	1.50	.050	15
ar year—						
9	do	32,100	4,153.00	622.95	.129	15

. 4, 1913, to June 30, 1914, under act of 1913.

ınd steel, and manufactures of: Sheets and plates (except saw plates) when made by the semer, Siemans-Martin, open-hearth, or similar process, not containing alloys such nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, ium, uranium, tantalum, boron, and similar alloys—Galvanized or coated with ', spelter, or other metals, or any alloy of these metals—Imports for consumption—enue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
year:		*Pounds.*				*Per cent.*
4[1]	15 per cent	23,144	$1,407.00	$211.05	$0.061	15
5	do	25,567	2,562.08	384.30	.100	15
6	do	41,463	1,540.00	231.00	.037	15
7	do	500	81.00	12.15	.162	15
8	do	150,761	52,304.00	7,845.60	.347	15
9	do	15,422	5,584.00	837.60	.362	15
ar year—						
9	do	67,220	17,923.00	2,688.45	.267	15

. 4, 1913, to June 30, 1914, under act of 1913.

and steel, and manufactures of: Sheets and plates (except saw plates) when made by crucible, electric, or cementation process, either with or without alloys, and finished by ing, hammering, or otherwise—Galvanized or coated with zinc, spelter, or other metals, ny alloys of these metals—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
year:		*Pounds.*				*Per cent.*
4[1]	15 per cent	238	$13.68	$2.05	$0.057	15
5	do	67,428	1,838.00	275.70	.027	15
6	do	7,914	251.00	37.65	.032	15
7	do	15,391	1,476.00	221.40	.096	15
8	do	64	10.00	1.50	.156	15
ar year—						
9	do	12,179	1,892.00	283.80	.155	15

. 4, 1913, to June 30, 1914, under act of 1913.

Galvanized iron and steel sheets [1]—Domestic exports (fiscal years).

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Norway	4,214,582	$110,246	295,231	$8,665	358,211	
Spain	465,184	13,294				
Canada	83,011,277	2,428,687	53,655,037	1,595,003	49,559,862	1,
Guatemala	1,600,074	51,927	434,511	14,230	356,928	
Mexico	19,347,350	622,790	2,165,782	75,615	1,886,842	
Cuba	12,405,578	362,127	5,093,577	150,727	2,861,136	
Dominican Republic	480,871	15,474	695,739	21,993	740,459	
Argentina	18,535,889	513,586	2,215,761	65,191	7,082,662	
Brazil	3,511,186	101,959	1,463,038	43,794	3,380,053	
Chile	11,160,505	337,075	88,191	2,653	767,598	
Colombia	5,668,160	182,268	3,545,117	108,468	2,327,159	
Peru	4,495,375	131,352	1,575,696	49,399		
China	6,319,609	208,698	1,687,962	57,248	3,188,267	
British India	5,952,282	161,451			16,134,130	
Dutch East Indies	2,765,183	87,151	912,886	30,919	2,902,922	
Japan	12,983,746	393,093	6,224,029	213,941	5,282,155	
Australia	17,295,055	503,273	425,820	14,272	1,607,175	
Philippine Islands	16,177,580	521,523	27,678,422	961,730	8,546,472	
British South Africa	4,267,897	119,847	796,858	22,585	1,038,034	
All other	26,159,153	787,135	11,423,595	336,992	15,079,396	
Total	256,816,536	7,652,956	120,377,252	3,773,425	123,099,461	3,

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Va
	Pounds.		*Pounds.*		*Pounds.*	
Italy	1,161,724	$36,022	1,905,056	$86,537	1,494,015	$
Norway	1,906,169	72,155	6,798,063	324,636	1,372,649	
Spain	717,619	18,872	1,424,650	73,600	2,176,757	
Canada	54,233,665	2,309,193	42,794,608	2,459,739	41,913,018	2,
Guatemala	381,172	15,047	824,528	41,504	3,559,250	
Mexico	2,387,967	98,536	4,831,098	270,523	5,558,014	
Cuba	19,182,555	700,683	22,687,789	1,023,166	7,304,622	
Dominican Republic	1,701,741	74,650	3,098,189	165,736	1,912,409	
Argentina	17,080,843	593,098	13,983,120	646,959	10,751,704	
Brazil	4,030,891	156,445	5,597,675	270,056	4,820,042	
Chile	1,881,066	63,333	4,718,611	242,368	13,347,301	1,
Colombia	4,956,038	182,865	3,757,157	181,825	1,570,103	
Peru	561,882	18,517	1,193,305	59,294	1,732,697	
China	3,689,276	185,362	1,809,966	95,361	2,986,553	
British East Indies	2,194,861	43,590	14,455,137	686,094	1,939,187	
Dutch East Indies	4,801,144	173,390	7,403,332	381,052	7,926,834	
Japan	4,000,821	149,723	8,982,162	463,810	5,771,563	
Australia	5,815,391	222,497	7,623,420	372,536	19,556,346	1,
Philippine Islands	12,754,353	449,518	4,119,294	205,432	8,863,932	
British South Africa	5,539,831	175,533	10,166,899	496,060	12,238,846	1,
All other	28,435,289	1,036,215	35,302,241	1,751,741	21,597,622	1,
Total	177,414,298	6,775,244	203,476,300	10,298,029	178,393,464	14,

[1] Included in "Iron-All other" prior to 1913.

Galvanized iron and steel sheets and plates—Domestic exports.
CALENDAR YEARS.

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Val
	Pounds.		*Pounds.*	
France	3,915,354	$291,286	3,206,659	$1
Canada	23,157,529	1,392,805	37,337,187	2,1
Guatemala	4,862,611	392,111	3,364,932	2
Mexico	3,750,531	311,128	6,506,722	
Cuba	8,685,703	676,792	18,080,840	1,0
Argentina	9,225,031	794,908	17,927,169	1,2
Brazil	4,525,430	406,405	8,539,094	
Chile	8,256,909	657,438	7,566,573	
Colombia	874,669	72,841	4,211,832	2
Uruguay	1,684,714	133,600	3,670,776	2
Dutch East Indies	6,411,139	636,698	3,856,163	2
Japan	5,337,953	519,412	13,313,507	7
Australia	30,540,430	2,560,449	30,794,350	2,3
New Zealand	2,205,133	195,577	4,014,095	2
Philippine Islands	7,326,060	643,356	15,146,299	1,1
British South Africa	7,850,395	724,667	7,102,772	
Portuguese Africa			3,658,231	2
Total	153,982,456	12,609,628	227,669,237	15,2

No. 28 galvanized sheets—Prices, average at Pittsburgh, per pound.

[From Iron Age, Jan. 6, 1921.]

	1899	1900	1901	1902	1903	1904	1905
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
	3.08	3.83	4.36	4.64	3.70	3.36	3.35
y	3.62	4.09	4.36	4.36	3.70	3.25	3.40
	4.17	4.32	4.84	4.36	3.78	3.23	3.45
	4.25	4.78	4.84	4.36	3.89	3.23	3.45
	4.25	4.66	4.74	4.36	3.88	3.23	3.45
	4.52	4.59	4.59	4.23	3.81	3.18	3.35
	4.72	4.53	4.48	4.26	3.73	3.14	3.36
	4.85	4.43	4.74	4.18	3.66	3.14	3.32
er	4.59	4.33	4.73	3.99	3.66	3.14	3.30
	4.53	4.25	4.55	3.87	3.73	3.14	3.30
er	4.21	4.16	4.84	3.85	3.51	3.23	3.32
r	3.88	4.36	4.84	3.78	3.40	3.31	3.35
erage	4.22	4.36	4.66	4.19	3.70	3.22	3.38
	4.85	4.78	4.84	4.64	3.89	3.36	3.45
	3.08	3.83	4.36	3.78	3.40	3.14	3.30

	1906	1907	1908	1909	1910	1911	1912
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
	3.45	3.67	3.59	3.55	3.50	3.20	2.90
y	3.45	3.75	3.55	3.51	3.50	3.20	2.87
	3.43	3.75	3.55	3.26	3.50	3.20	2.80
	3.40	3.75	3.55	3.25	3.50	3.20	2.86
	3.40	3.76	3.55	3.25	3.50	3.20	2.90
	3.55	3.75	3.55	3.25	3.50	3.00	2.90
	3.55	3.75	3.55	3.25	3.39	3.00	3.00
	3.55	3.75	3.55	3.25	3.30	2.99	3.12
er	3.55	3.75	3.55	3.28	3.21	2.93	3.21
	3.58	3.75	3.55	3.35	3.20	2.85	3.36
er	3.65	3.75	3.55	3.43	3.20	2.85	3.40
r	3.65	3.75	3.55	3.50	3.19	2.89	3.40
erage	3.52	3.74	3.55	3.34	3.37	3.04	3.06
	3.65	3.75	3.59	3.55	3.50	3.20	3.40
	3.40	3.67	3.55	3.25	3.19	2.85	2.80

	1913	1914	1915	1916	1917	1918	1919	1920
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
	3.46	2.87	2.79	4.75	6.25	6.25	6.05	5.32½
r	3.50	2.95	3.16	4.75	6.38	6.25	6.05	6.50
	3.50	2.95	3.40	4.75	6.69	6.25	5.96	7.00
	3.50	2.91	3.29	5.00	7.00	6.25	5.70	7.00
	3.42	2.80	3.50	4.94	8.20	6.25	5.70	7.00
	3.38	2.75	4.28	4.69	9.50	6.25	5.70	7.00
	3.33	2.75	4.40	4.38	10.00	6.25	5.70	8.25
	3.24	2.85	3.71	4.21	10.00	6.25	5.70	9.00
er	3.16	2.95	3.56	4.18	9.75	6.25	5.70	8.87½
	3.08	2.95	3.50	4.41	.....	6.25	5.70	8.18
r	2.98	2.88	3.39	5.18	6.25	6.25	5.70	7.04
r	2.90	2.78	4.75	6.00	6.25	6.15	5.70	5.70
erage	3.29	2.87	3.69	4.77	7.84	6.24	5.78	7.24
	3.50	2.95	4.75	6.00	10.00	6.25	6.05	9.00
	2.90	2.75	2.79	4.18	6.25	6.15	5.70	5.32½

Galvanized corrugated sheets, 24 G—Prices per gross ton.

[From Iron and Coal Trades Review (London).]

	English currency.	Normal rates of exchange.	Current rates of exchange.	Cents per pound.
	£ s. d.			
	52 12 0	$255.98	$205.57	0.09
	48 10 0	236.03	176.82	.08
r	43 12 6	212.30	153.51	.07
	39 6 0	191.25	136.20	.06

Court and Treasury Decisions.

Corrugated-iron sheets that have been galvanized were held n
be dutiable under paragraph 131 of the act of 1897, but dutiable
paragraph 193 of that act, though not subject to the addit
two-tenths of 1 cent per pound under paragraph 132 of said
(Moore *v.* United States, 1 Ct. Cust. Appls. 115, of 1910.)

Galvanized sheets—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, and ad valor
1883	151	Boiler or other plate iron, sheared or unsheared, skelp-iron, sheared or rolled in grooves.	1¼ cents per p
		Sheet iron, common or black:	
		Thinner than 1¼ inches and not thinner than No. 20 wire gauge.	1$\frac{1}{10}$ cents per p
		Thinner than No. 20 wire gauge and not thinner than No. 25 wire gauge.	1$\frac{1}{10}$ cents per p
		Thinner than No. 25 wire gauge and not thinner than No. 29 wire gauge.	1$\frac{1}{10}$ cents per p
		Thinner than No. 29 wire gauge, and all iron commercially known as common or black taggers' iron, whether put up in boxes or bundles or not.	30 per cent ad v
		And provided, That on all such iron and steel sheets or plates aforesaid excepting on what are known commercially as tin plates, terneplates, and taggers' tin, and hereafter provided for, when galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals.	$\frac{1}{2}$ cents per po ditional.
1890	143	All iron or steel sheets or plates, and all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates terneplates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals, shall pay.	$\frac{1}{2}$-cent per pou duty than t imposed by ceding pa upon the cor ing gauges, o of common sheet or tagg or steel.
1894	119	All iron or steel sheets or plates, and all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates, terneplates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals, shall pay.	$\frac{1}{2}$ cent per pou duty than t imposed by ceding pa upon the cor ing gauge or common or sheet or tagg or steel.
1897	132	All iron or steel sheets or plates, and all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates, terneplates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals shall pay.	$\frac{1}{10}$ cent per pou duty than if was not s nized or coat
1909	128	All iron or steel sheets or plates, and all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates, terneplates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals, shall pay.	$\frac{1}{10}$ cent per pou duty than if was not s nized or coat
1913	109	All iron or steel sheets, plates, or strips, and all hoop, band, or scroll iron or steel, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals.	15 per cent ad

Foreign rates of duty (Kelly).

CANADA.

Act of—	Par.	Tariff classification or description.	Rates of duty, specifi valorem.		
			British preferential tariff.	Intermediate tariff.	
1907	384	Rolled iron or steel sheets and strips, polished or not, No. 14 gauge and thinner, n. o. p.; * * * and rolled sheets of iron or steel, coated with zinc, spelter, or other metal, of all widths or thicknesses, n. o. p.; and rolled iron or steel hoop, band, scroll, or strip, No. 14 gauge and thinner, galvanized, or coated with other metal, or not, n. o. p.	Free.	*Per cent.* 7½	

Foreign rates of duty (Kelly)—Continued.

FRANCE.

Act of—	Par.	Tariff classification or description.	Rate.[1] General tariff.	Rate.[1] Minimum tariff.
1911	211	Iron, tinned (fer blanc), coppered, or covered with zinc or lead (except galvanized corrugated sheets):		
		Of more than six-tenths of a millimeter in thickness, per 100 kilos (N).	Fr. c. 14 00	Fr. c. 12 00
		American currency, per 100 pounds	$1.22	$1.05
		Six-tenths of a millimeter in thickness or less, per 100 kilos (N)	15 00	13 00
		American currency, per 100 pounds	$1.31	$1.14

[1] Additional taxes and 4 per cent included.

GERMANY.

Act of—	Par.	Tariff classification or description.	Rate.—General tariff.
1909	788	Sheets and plates:	
		Tinned (tin plate) or otherwise coated with other common metals or alloys of common metals.	*Marks.*
		More than 1 millimeter in thickness, per 100 kilos (N)	5 00
		American currency, per 100 pounds	$0.54
		1 millimeter or less, per 100 kilos (N)	$5.50
		American currency, per 100 pounds	$0.59
		Tare: Cases, 10; casks, 10; baskets, 6.	
		NOTE.—In the case of sheet iron less than 5 millimeters in thickness and cut otherwise than rectangularly the duty will be increased by 25 per cent.	

STRIP STEEL.

SUMMARY.

Strip steel consists of long, narrow, and thin pieces of steel generally varying from one-half inch to 16 inches in width and from six one-thousandths to one-half inch in thickness. It is made and sold in two grades, hot and cold rolled. Cold-rolled strip steel represents a more advanced stage in production than the hot-rolled product and is specified when a smooth finish is desired. Hot-rolled strip steel is used for fabricating boiler tubes, door hangers, metal beds, stove parts, bands, and similar material. Cold-rolled strip steel is employed in the making of automobiles, cash-register and typewriting parts, high-grade tubing, fine hardware, and the like.

Published statistics regarding strip steel usually group it with steel hoops, bands, flat wire, and sometimes with sheets. It is therefore impossible to state the country's output with any degree of precision. The same is true of foreign countries. In England, however, the National Federation of Iron and Steel Manufacturers publishes figures for strips and hoops. In 1918 the output for the two commodities amounted to 202,046 gross tons, of which nearly one-fourth was exported.

While an appreciable amount of strip steel is imported, the ratio of imports to domestic production is small. In the calendar year 1919 the imported strip steel amounted to only 62,199 pounds (27.8 gross tons). In the fiscal year 1918 it was much larger, but then only aggregated 859,757 pounds (383.8 gross tons).

There is but little competition from abroad in the manufacture of strip steel. The raw material consists of billets and slabs of domestic manufacture. This material is subject to heating and rolling under conditions similar to those existing in the manufacture of ordinary steel sheets. In the case of the cold-rolled article, the hot-rolled steel is subjected to pickling and generally annealing as well as additional rolling. All these processes are as cheaply done in this country as in any other in the world. Where strips are galvanized, the cost of spelter is the most important item in the conversion expense, and spelter is as cheaply obtained here as in any other country.

In the matter of classification there is need for clearer definitions of hoops, bands, flat wire, and strips, as these are often grouped together in trade statistics and the terms frequently used interchangeably. Strip steel, however, is coming to be associated with the manufacture of certain classes of articles distinct from these into which hoops, bands, etc., enter. Cold-rolled strip steel is more advanced in the stage of production than the hot-rolled product, generally selling at a price 50 to 75 per cent in advance of the latter. Galvanized strip steel, which is ordinary strip steel properly treated and coated with zinc or spelter, is also a product further advanced in production than the hot-rolled product. Where specific rates are imposed these differences should be recognized.

Strips of iron or steel—Summary table.

Fiscal year.	Imports for consumption.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
	Pounds.				*Per cent.*
[illegible]	[1] 254,991	$230,164	$83,578.69	(2)	36.31
[illegible]	[1] 268,759	306,321	108,211.40	(2)	35.33
[illegible]	2,013,970	213,884	75,764.59	$0.106	35.42
[illegible]	3,883,150	289,112	102,646.84	.081	35.50
[illegible]	1,181,738	119,078	29,804.87	.101	25.03
[illegible]	201,065	14,851	2,008.35	.074	13.52
[illegible]	40,965	2,261	273.15	.055	12.08
[illegible]	243,462	53,264	7,449.03	.219	13.99
[illegible]	839,757	337,807	49,653.51	.393	14.70
[illegible][3]	315,341	163,100	23,790.66	.517	14.59
[illegible][3]	62,199	19,329	2,664.66	.311	13.78

[1] Does not include "bands and strips of steel exceeding 12 feet in length, n. s. p. f.," for which no quantities were given in 1910 and 1911.
[2] Quantity not comparable with value, see note [1] on quantity sheet.
[3] Calendar year.

General Information.

TARIFF ACT OF 1913.

PAR. 105. * * * strips of iron or steel not specially provided for in this section; * * * 12 per cent ad valorem.

PAR. 109. All iron or steel * * * strips, * * * when galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals; * * * 15 per cent ad valorem.

DESCRIPTION.

Strip steel consists of long,, narrow, and thin pieces of steel of varying widths and thicknesses. Most strip mills in this country are equipped for rolling strips from one-half inch to 16 inches wide and from six one-thousandths to one-half inch thick, and in lengths up to 300 feet. Strip steel has practically supplanted strip iron.

The terms hoops, bands, flat wire, and strips are often used interchangeably or with overlapping significance. There is need for more clearly defined meanings with respect to the use of these terms. What are called steel strips are generally used in the manufacture of relatively high-grade steel articles.

Classes and uses.—Strip steel is made in two grades, hot and cold rolled, the latter being specified when a smooth finish is desired. Hot-rolled strip steel is used for fabricating boiler tubes, door hangers, metal beds, stove parts, automobile side braces and brake bands, and the like. The cold-rolled product is employed for the making of autobomile, cash register, and typewriter parts of all descriptions, high-grade tubing for wind shields, beds, fine hardware, stove trimmings for nickel-plate work, forks and spoons, bicycle and motor truck chains, and for deep drawn work such as automobile headlights, one-piece oil cans, electrical appliances, talking-machine parts, etc.

DOMESTIC PRODUCTION.

Strip steel, as shown above, has a great variety of uses. Measured in tonnage output, however, its importance, while great, is less than that of sheets, plates, structural shapes, rails, or similar groups of steel products.

Raw material.—Billets and slabs ranging from 4 to 18 inches in width and from 3 to 10 feet in length constitute the raw material used for rolling hot-strip steel. Billets are used for the narrower strips and slabs for the wider ones. The billets and slabs are of domestic manufacture.

Equipment and method of production.—The manufacture of strip steel is accomplished in rolling mills, of which there are several types. In hot rolling the slabs or billets are preheated in automatic, gravity-discharge furnaces, which are usually about 40 by 11 feet in size and will handle about 500 tons in 24 hours. The rate of travel through the furnace is so regulated that the steel is brought to desired temperature prior to being discharged from the furnace. The heated steel is then subjected to the rolling process and reduced to the proper dimensions. After cropping irregular ends and cutting to proper lengths the hot-rolled product is shipped in strips or coils either plain, pickled, and limed, or pickled and oiled.

In cold-rolling the strips are subjected to additional pressure to secure a smooth and even surface. Before cold-rolling all strips are pickled, i. e., cleaned with acid and water, to remove scale. As the hot-rolling process imparts a certain amount of hardness to the strip steel which with most material must be removed before cold-rolling the steel is annealed, i. e., reheated in rectangular furnaces to a temperature of about 1,400° to 1,600° F., and then allowed to cool slowly, first in the furnace for 24 to 36 hours, and then outside under cover for about 96 hours. The annealing process gives the necessary softness. Where, however, hard, cold-rolled steel is desired, there is no annealing done either before or after cold-rolling.

In cold-rolling the average reduction is small, ranging from four to six gauges. The cold-rolled product is cut to specified lengths, again annealed to soften the texture, and oiled to prevent oxidation.

Where strips are galvanized the process is the same as that described in survey on galvanized sheets (q. v.).

Organization and geographical distribution.—The manufacture of strip steel is a specialized phase of the steel industry and often takes place in mills independent of the larger steel corporations. However, a considerable amount of strip steel is manufactured in the mills of large producers. In all cases much capital is required for the proper equipment of rolling mills.

The mills making strip steel are located in the northeastern part of the United States, especially in the States of Pennsylvania, Ohio, Connecticut, New York, New Jersey, Massachusetts, and West Virginia.

Domestic production and consumption.—Statistics regarding the output of steel strips are not separately published in the United States. The American Iron and Steel Institute publishes figures on hoops and on bands and cotton ties which include strip steel. The country's output of the former in 1919 amounted to 233,336 gross tons, and that of the latter, to 352,172 gross tons. These figures *give no indication* of the actual output of steel strips alone.

The consumption of steel strips in the United States is large. Exports are not separately listed in the Government's published figures It is known, however, that the greater part of the domestic output is consumed at home. The imports, while appreciable, are small compared with the home production.

FOREIGN PRODUCTION.

Steel strips are produced in England and Germany. As in the United States published figures include more than strip steel. In England strips and hoops are combined, and the production in 1918 amounted to 202,046 gross tons. In 1915, the corresponding output amounted to 176,036 gross tons.[1] Between 20 to 30 per cent of the English production is exported. Of the 202,046 gross tons manufactured in 1918, 44,045 gross tons were exported. In 1913 exports amounted to 45,708 gross tons.[2]

IMPORTS.

The imports of strip steel amounted to only 62,199 pounds (27.8 gross tons) in the calendar year 1919. About one-third of this importation, 21,887 pounds, consisted of galvanized strips. In the fiscal year 1918 the imports amounted to 859,757 pounds (383.8 gross tons), of which 722,245 pounds consisted of the galvanized product.

Prior to 1914 import figures include bands and during the fiscal years 1912 and 1913 the combined imports ranged from 2,000,000 to over 3,500,000 pounds. A large part of this importation, however, would not come under the designation of strip steel.

PRICES.

The price of strip steel is generally quoted by the pound,[3] and as hot-rolled or cold-rolled. The cold-rolled product being more advanced, ranges considerably higher in price than the hot-rolled. About the middle of October, 1920, for example, hot-rolled strip steel sold at 5 cents per pound, Pittsburgh, Pa., while the cold-rolled product sold at 8 cents.[4]

The price of galvanized strips is also quoted by the pound, the quotation generally ranging much higher than that for the hot-rolled product.

After the outbreak of war in 1914 the prices of strip steels fluctuated in much the same way as other steel products. In 1916 and the first half of 1917 the upward movement of prices was pronounced. The price-fixing policy of the Government, initiated in September, 1917, checked this movement, although strip steel was not directly affected until later. In January, 1918, hot-rolled steel strip sold at $4.50 per 100 pounds, Pittsburgh, and the cold-rolled product, for $6.50 per 100 pounds. The terms for the latter were 30 days or less, less 2 per cent for cash in 10 days when sold in quantities of 300 pounds or more. In the summer of 1918 the prices for the hot-rolled product declined

[1] Statistical Report of the National Federation of Iron and Steel Manufacturers 1918, p. 6.
[2] Ibid., p. 9.
[3] As in the case of several other steel products generally quoted by the pound, the price is sometimes given in so many dollars per 100 pounds.
[4] Iron Age, Oct. 14, 1920, p. 1005.

to $3.50 for 100 pounds, while cold-rolled strip steel was still quoted at $6.50 per 100 pounds.

In 1919 the quotation on hot-rolled strips ranged from 3.05 to 3.7 cents per pound, and in 1920 from 3.50 cents to as high as 7.00 cents. Cold-rolled strips were quoted at 5.65 to 6.25 cents per pound in 191 and 6 to 9.75 cents per pound in 1920.

TARIFF HISTORY.

Much of the history of strip steel is already covered in the survey of the iron and steel sheets; hoop, band, or scroll iron or steel, steel bars; and flat wire. What is called strip steel is often included under the head of bands or flat wire. The wider steel strips were grouped under sheets.

In the act of 1897 steel bands or strips, untempered, suitable for making band saws were dutiable at 3 cents per pound and 20 per cent ad valorem, and if tempered, or tempered and polished, 6 cents per pound and 20 per cent ad valorem. In the act of 1909, the rates varied from $\frac{2}{10}$ cents to $1\frac{4}{10}$ cents per pound and 35 per cent ad valorem. In the act of 1913 ad valorem rates entirely supplanted specific ones, the rate on ordinary steel strips being 12 per cent ad valorem, and on the galvanized product 15 per cent.

TARIFF PROBLEMS.

There are no tariff problems with respect to competitive conditions. The revenue possibilities, while appreciable, are not great, as the home demand can be more readily satisfied by the domestic material than by the foreign.

In the matter of classification strip steel should be separated from hoops, band, and scroll iron or steel. There is need for a better understanding of what comes under the designation of strips. The hot-rolled and cold-rolled products should also be carefully separated as their uses and values vary considerably.

Strips of iron or steel—Production in principal foreign countries.

[From National Federation of Iron and Steel Manufacturers.]

Year.	United Kingdom.	Year.	United Kingdom.
	Gross tons.[1]		*Gross tons.*
1915	176,036	1917	198,944
1916	186,416	1918	202,046

[1] Includes hoops with strips.

Strips of iron or steel—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	3 cents per pound and 20 per cent to 6 cents per pound and 20 per cent.	116,336	$15,191	$9,009.73	$0.131	59.31
1908	do	666,434	68,874	35,710.44	.104	51.85
1909	do	738,592	73,356	38,042.67	.099	51.86
1910	3 cents per pound and 20 per cent to $\frac{1}{16}$ cent per pound and 35 per cent.	[1] 254,991	230,164	83,578.69	[2]	36.31
1911	35 per cent to $\frac{1}{16}$ cent per pound and 35 per cent.	[1] 268,759	306,321	108,211.40	[2]	35.33
1912	do	2,013,970	213,884	75,764.59	.106	35.42
1913	do	3,583,150	289,112	102,646.81	.081	35.50
1914	12 per cent to $\frac{1}{16}$ cent per pound and 35 per cent.	1,181,738	119,078	29,804.87	.101	25.03
1915	12 per cent to 15 per cent.	201,065	14,851	2,008.35	.074	13.52
1916	do	40,965	2,261	273.15	.055	12.08
1917	do	243,462	53,284	7,449.03	.219	13.99
1918	do	859,757	337,807	49,653.51	.393	14.70
1918 [3]	do	315,341	163,100	23,790.66	.517	14.59
1919 [3]	do	62,199	19,329	2,664.66	.311	13.78

[1] Does not include "Bands and strips of steel exceeding 12 feet in length, n. s. p. f.," for which no quantities were given in 1910 and 1911.
[2] Quantity not comparable with value, see note (1).
[3] Calendar year.

Bands or strips of steel, suitable for making band saws—Untempered—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	3 cents per pound and 20 per cent.	33,621	$3,602	$1,720.03	$0.107	48.00
1908	do	601,670	59,401	29,930.00	.099	50.39
1909	do	698,135	67,419	34,427.85	.097	51.07
1910 [1]	do	164,018	16,374	8,195.34	.100	50.05

[1] July 1 to Aug. 5, 1909, under act of 1897.

Bands or strips of steel, suitable for making band saws—Tempered, or tempered and polished—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	6 cents per pound and 20 per cent.	82,715	$11,589	$7,280.70	$0.14	62.82
1909	do	64,764	9,473	5,780.44	.146	61.02
1910	do	40,457	5,937	3,614.82	.147	60.89
1910 [1]	do	6,701	1,096	621.26	.164	56.68

[1] July 1 to Aug. 5, 1909, under act of 1897.

Bands and strips of steel exceeding 12 feet in length, n. s. p. f.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	35 per cent		$195,908	$68,567.80		35.00
1911	do		250,820	87,787.00		35.00
1912	do	1,780,575	166,747	58,361.45	$0.094	35.00
1913	do	3,218,734	222,460	77,861.00	.07	35.00
1914 [2]	do	477,313	37,729	13,205.47	.079	35.00

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Bands and strips of steel exceeding 12 feet in length not specially provided for, cold-rolled, smoothed only, not polished—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1911	$\frac{4}{10}$ cent per pound and 35 per cent.	38,001	$9,004	$3,227.40	$0.237	35.84
1912	do	2,134	279	101.92	.131	36.53

Bands and strips of steel exceeding 12 feet in length, not specially provided for, cold-rolled, cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish, or polish better than the grade of cold-rolled, smoothed only—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	$\frac{4}{10}$ cent per pound and 35 per cent.	75,317	$16,039	$5,914.93	$0.213	36.88
1911	do	230,758	46,497	17,197.00	.201	36.99
1912	do	219,495	46,130	17,023.49	.21	36.90
1913	do	364,416	66,652	24,785.84	.183	37.19
1914 [2]	do	121,932	20,023	7,495.78	.164	37.44

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Bands and strips of steel exceeding 12 feet in length, not specially provided for, galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	$\frac{4}{10}$ cent per pound and 35 per cent.	8,955	$717	$279.36	$0.083	37.39
1911	do					
1912	do	11,466	728	277.73	.063	38.15
1913	do					
1914 [2]	do	14,259	905	345.27	.063	38.15

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Strips of iron or steel, not specially provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	12 per cent	83,805	$10,160	$1,219.20	$0.121	12.00
1915	do	88,622	7,310	877.20	.082	12.00
1916	do	40,640	2,200	264.00	.054	12.00
1917	do	119,172	18,019	2,162.28	.151	12.00
1918	do	137,512	33,918	4,070.16	.247	12.00
1918 [2]	do	81,085	22,478	2,697.36	.277	12.00
1919 [2]	do	40,312	7,823	938.76	.194	12.00

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913. [2] Calendar year.

Strips of iron or steel, not specifically provided for, galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	15 per cent	484,429	$50,261	$7,539.15	$0.104	15.00
1915	do	112,443	7,541	1,131.15	.067	15.00
1916	do	325	61	9.15	.188	15.00
1917	do	124,290	35,245	5,286.75	.284	15.00
1918	do	722,245	303,889	45,583.35	.421	15.00
1918 [2]	do	234,256	140,622	21,093.30	.60	15.00
1919 [2]	do	21,887	11,506	1,725.90	.526	15.00

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913. [2] Calendar year.

Hot-rolled strips, prices, cents per pound, f. o. b. Pittsburgh.

[From The Iron Age.]

	1919	1920		1919	1920
January	3.30	3.50–3.75	July	3.05–3.30	5.50
February	3.30	4.63–5.63	August	3.31	5.50
March	3.30	[1] 5.00–7.00	September	3.30	5.50
April	3.30	[1] 5.20–7.00	October	3.30	[2] 5.50
May	3.30	5.50–6.75	November	3.30	5.00
June	3.12–3.40	5.50	December	3.50–3.70	[3] 4.00

[1] For prompt shipment 8 to 10 cents per pound at mill is quoted.
[2] Makers holding for 5.50 cents per pound base, but a great many accepting 5 cents per pound.
[3] Effective Dec. 1.

Cold-rolled strips, prices, cents per pound, f. o. b. Pittsburgh.

[From The Iron Age.]

	1919	1920		1919	1920
January	6.25	6.00–6.50	July	5.65	8.50
February	6.25	7.00–9.00	August	5.65	8.50
March	6.10	[1] 7.00–9.75	September	5.65	8.50
April	5.65	7.60–9.40	October	5.65	[2] 8.50
May	5.65	8.50	November	5.65	8.00
June	5.65	8.50	December	5.65–6.00	[3] 7.00

[1] Some small lots have sold as high as 12 cents per pound for fairly prompt delivery.
[2] Most makers receiving only 8 cents per pound.
[3] Effective Dec. 1.

NOTE.—On Sept. 23 the American Steel & Wire Co. advanced from 5.75 to 6.25 cents base.

Court and Treasury Decisions.

Lines of demarkation between balls, bands, or strips, sheets, ıtes of steel have been defined by the Treasury Departm . D. 34694 of 1914.)

A strip of high-grade steel 50 feet long by 8 inches wide, fitted composition to be used only for making saws and which nmercially known as a saw plate, was held dutiable as such u ragraph 122 of the act of 1894 and not under paragraph 11 at steel, nor under paragraph 124 as sheet steel in strips. (Bel United States, 91 Fed., 975, of 1898.)

Steel strips flattened from round steel wire not smaller than 13 uge and cut into lengths, not valued at above 3 cents per po re held dutiable under paragraph 122 of that act and not u ragraph 124. (United States *v.* Boker, 90 Fed., 804.)

Strips of steel 3 inches wide, from 100 to 250 feet long, and an 0.025 of an inch in thickness, which had been shaped by pas rough coiled rolls, were held dutiable under the provisions for " el wire or sheet steel in strips" in paragraph 148 of the act of 1 nited States *v.* Wetherell, 65 Fed., 987, of 1894.)

The provision in paragraph 137 of the act of 1897 for sheet s strips was held not to include long, narrow, thin, cold rolled, s ips, because they were not sheet steel nor stripped from s el, nor commercially known as sheet steel in strips. (United St Boker, 158 Fed., 396, of 1907.)

The provision in paragraph 141 of the act of 1897 for "strip s d rolled, cold hammered, blued, brightened, tempered, or poli any process to such perfected surface finish better than the g cold rolled, smoothed only," was construed to require that etter" surface finish or polish must be produced by some pro ıer than cold rolling and that the provision did not include cer ip steel not subjected to any other treatment than passage sev ıes through cold rolls, together with the pickling lime bath ılining incident to the cold-rolling process, there being no p ıt the expression "cold rolled, smoothed only," had any gen ll recognized commercial meaning that would exclude such st d the practice under former legislation having been not to app ıilar provision to like merchandise. (United States *v.* Cruc el Co., 137 Fed., 384; 154 Fed., 1005, affirming 147 Fed., 537.)

Steel strips plated with nickel, or something more than steel st d not being specifically provided for in their advanced condit re held to come within the provision in the act of 1909 for ma tures of metal. These strips exceeded 12 feet in length and v elared "concededly not iron or steel sheets or plates, nor * * op, band, or scroll iron or steel, according either to the provis paragraph 124 or those of paragraph 128" of the act of 1 irsch *v.* United States, 4 Ct. Cust. Appls., 82, of 1913.)

Paragraph 135 of the act of 1909 was declared to exhibit cer ll-defined changes from previous enactments that dealt with ne subject matter and was not to be construed according to ıctice of the customs or the decisions of law controlling the ıctment, and the provision for "steel strips, not thicker than

ire gauge, and not exceeding 5 inches in width, whether in long ıort lengths, in coils or otherwise, and whether rolled or drawn ugh dies or rolls, or otherwise produced," was construed to apply essemer cold-rolled steel, 3 inches in width, varying from 0.022 to 7 in thickness, and in coils about 60 feet long, imported for use netal in the manufacture of corset clasps. (Strouse *v.* United es, 3 Ct. Cust. Appls., 184, of 1912.)

eel strips more than 5 inches in width were held dutiable under provisions in paragraph 105 of the act of 1913 for strips of iron teel not provided for, rather than under paragraph 110. (Abct 40203, of 1916, following G. A. 7861, T. D. 36176, of 1916.)

Strips of iron and steel—Rates of duty.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
116	Hoop, band, or scroll iron or steel, except as otherwise provided for in this act.	30 per cent ad valorem.
122	* * * saw plates, wholly or partially manufactured; * * *; all of the above valued at 1 cent per pound or less.	$\frac{1}{10}$ cent per pound.
	Valued above 1 cent and not above 1.4 cents per pound	$\frac{1}{10}$ cent per pound.
	Valued above 1.4 cents and not above 1.8 cents per pound	$\frac{2}{10}$ cent per pound.
	Valued above 1.8 cents and not above 2.2 cents per pound	$\frac{3}{10}$ cent per pound.
	Valued above 2.2 cents and not above 3 cents per pound	$\frac{4}{10}$ cent per pound.
	Valued above 3 cents and not above 4 cents per pound	1.2 cents per pound.
	Valued above 4 cents and not above 7 cents per pound	1.3 cents per pound.
	Valued above 7 cents and not above 10 cents per pound	1.9 cents per pound.
	Valued above 10 cents and not above 13 cents per pound	2.4 cents per pound.
	Valued above 13 cents and not above 16 cents per pound	2.8 cents per pound.
	Valued above 16 cents per pound	4.7 cents per pound.
141	* * * and on all strips, plates, or sheets of iron or steel of whatever shape, other than the polished, planished, or glanced sheet-iron or sheet-steel hereinbefore provided for, which are cold rolled, cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, hereinbefore provided for, there shall be paid 1 cent per pound in addition to the rates provided in this act upon plates, strips, or sheets of iron or steel of common or black finish; * * *	
137	* * * on all strips, plates, or sheets of iron or steel of whatever shape, other than the polished, planished, or glanced sheet-iron or sheet-steel hereinbefore provided for, which are cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better the grade of cold rolled, smooth only, hereinbefore provided for, there shall be paid four-tenths of 1 cent per pound in addition to the rates provided in this section upon plates, strips, or sheets of iron or steel of common or black finish of corresponding gauge or value; * * *	
105	Boiler or other plate iron or steel, and strips of iron or steel, not specially provided for in this section; * * *	12 per cent ad valorem.
109	All iron or steel sheets, plates, or strips, and all hoop, band, or scroll iron or steel, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals; * * *	15 per cent ad valorem.

Strips of iron and steel—Foreign rates of duty (Kelly).

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.		
			British preferential.	Intermediate tariff.	General tariff.
		Canada.			
	378	* * * And rolled iron or steel hoop, band, scroll, or strip, 12 inches or less in width, No. 13 gauge and thicker, n. o. p.....per ton..	$4.25	$6.00	$7.
		And.....	.....	[1] 7½	1
	384	Rolled iron or steel sheets and strips, polished or not, No. 14 gauge and thinner, n. o. p.: * * * and rolled iron or steel hoop, band, scroll, or strip, No. 14 gauge and thinner, galvanized, or coated with other metal, or not, n. o. p.....	Free.	[1] 7½	1
	384-a	Rolled iron or steel hoop, band, scroll, or strip, No. 14 gauge and thinner, and rolled iron or steel, sheet, when imported by manufacturers for use only in their own factories in the manufacture of galvanized iron or steel hoop, band, scroll, strip, or sheet.....	Free.	Free.	Fre
	386	Rolled iron or steel, and cast steel in bars, bands, hoop, scroll, strip, sheet, or plate, of any size, thickness, or width * * *.....	[1] 7½	[1] 12½	1 12
			Additional taxes and 4 per cent included.		
			General tariff.	Maximum tariff.	
		France.			
	209	Hoop iron or steel: Hot rolled of 1 millimeter or more in thickness, per 100 kilograms G [2].....	Fr. c. 9.75	Fr. c. 6.
		(American currency, per 100 pounds) [3].....	$0.95	$0.
	209-b	Cold rolled of a thickness of: More than 1 millimeter per 100 kilograms N.....	12.00	8.
		(American currency, per 100 pounds) [3].....	$1.05	$0.
		6/10ths to 1 millimeter per 100 kilograms N.....	13.00	9.
		(American currency, per 100 pounds) [3].....	$1.14	$0.
		4/10ths to 6/10ths of a millimeter per 100 kilograms N..	16.00	11.
		(American currency, per 100 pounds) [3].....	$1.42	$0.
		Less than 4/10ths of a millimeter per 100 kilograms G..	19.00	13.
		(American currency, per 100 pounds) [3].....	$1.66	$1.

[1] Per cent.
[2] Hot-rolled hoop iron or steel less than 1 millimeter in thickness pays duty under 209-b.
[3] At the normal rate of exchange.

This statement that hoop, band, or scroll steel is similar to strip steel but thinner needs consideration of the trade specifications. This survey gives hoop, band, and scroll steel as 0.025 to 0.095 inch thick, 3.8 to 8 inches wide. The American Iron and Steel Institute maximum prices gives hoops, bands, and strips all the same dimensions, and cold-rolled strips 0.035 inch thick to 15 inches wide, and manufacturers of special steel strips 0.035 inch thick to 2 inches and wider.

See Survey of sheets further advanced than hot rolled.

HOOP, BAND, OR SCROLL IRON OR STEEL, GALVANIZED OR NOT.

SUMMARY.

Hoop, band, or scroll steel is a rolling-mill product, similar to strip steel but thinner. It is used for the manufacture of barrel hoops, cotton ties, and to some extent for saw blades, and is furnished either plain, galvanized, or painted.

In recent years the imports have been extremely small, valued at less than $1,000 a year since 1915, although prior to the war the value of the imports amounted in certain years to over $300,000.

The exports, on the other hand, have materially increased during and since the war, being valued in 1918 at more than $8,000,000, as compared with only $528,000 in 1914. In spite of lower prices and a slight reduction in tonnage, the value of the exports in 1920 was over $5,000,000.

Domestic manufacturers are apparently at no serious disadvantage, although the quality of British galvanized products may result in a continued trade with the United States in barrel hoops and strips, coated with zinc.

Under the tariff act of 1913 hoop or band iron or steel is dutiable at 10 or 15 per cent ad valorem, whereas cotton ties, a product manufactured from this material, is on the free list.

Hoop, band, or scroll iron or steel, galvanized or not—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption.	Domestic exports.	Ratio to production.	
				Imports.	Exports.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Per cent.*	*Per cent.*
1910	.....	411	5,239	.....	.....
1911	.....	363	.....	.....	.....
1912	.....	2,091	8,238	.....	.....
1913	780,546	2,004	18,312	0.26	2.35
1914	556,947	1,006	11,507	.18	2.10
1915	719,746	302	15,097	.04	2.09
1916	930,719	132	41,167	.01	4.42
1917	838,079	7	48,059	.....	5.73
1918	513,048	31	58,782	.....	11.46
1919	585,508	35	56,544	.....	.....
1920	.....	.....	45,282	.....	.....

Year.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity (pound).	Equivalent ad valorem rate.
				Per cent.
1910	[2] $239,096	$86,239.19	[4] $0.047	36.07
1911	[3] 315,540	109,854.67	[4] .079	34.81
1912	254,041	83,843.83	.054	33.00
1913	300,161	106,255.92	.057	35.40
1914	88,136	24,838.84	.039	28.18
1915	10,522	1,212.90	.016	11.53
1916	7,367	1,103.40	.025	14.98
1917	546	54.80	.036	10.04
1918	1,952	280.70	.028	14.38
1919	7,652	791.00	.096	10.34

[1] Includes "cotton ties" in addition to "hoops and bands."
[2] Includes $195,908 worth of bands or strips of steel exceeding 12 feet in length, for which no quantity was stated.
[3] Includes $250,820 worth of bands or strips of steel exceeding 12 feet in length, for which no quantity was stated.
[4] Calculated on $43,188 and $64,720 values of imports of stated quantities for 1910 and 1911, respectively.

General Information.

1913 TARIFF PARAGRAPHS.

PAR. 107. Hoop, band, or scroll iron or steel not otherwise provided for in this section, and barrel hoops of iron or steel, wholly or partly manufactured, 10 per cent ad valorem.

PAR. 109. * * * all hoop, band, or scroll iron or steel, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals, 15 per cent ad valorem.

DESCRIPTION.

This survey includes all hoop, band, or scroll iron not otherwise specially provided for. Specifically excluded is hoop or band iron, or hoop or band steel, cut to lengths, or wholly or partly manufactured into hoops or ties for baling cotton or any other commodity.[1] Specifically included in addition to hoop, band, or scroll iron or steel are barrel hoops of iron or steel, bands or strips of steel suitable for making saws, and bands or strips of steel exceeding 12 feet in length, not specially provided for.

Hoop, band, or scroll iron or steel is a rolling-mill product, rolled from iron or steel blooms, slabs, or billets. Ordinarily it has a thickness ranging from 0.025 inch to 0.095 inch and a width of from 3.8 inches to 8 inches. It is coiled in bundles, and when coiled in the form of a figure 8 it is known as scroll iron. It may also be referred to as strap iron or ribbon iron.

DOMESTIC PRODUCTION.

Statistics of domestic production of hoops and of bands and cotton ties are given separately by the American Iron and Steel Institute, but this separation is not the same as that adopted in the tariff act, cotton ties being on the free list. The maximum output was in 1916, when it amounted to 368,164 tons of hoops and 562,555 tons of bands and cotton ties. In addition to this tonnage there was doubtless a small amount of hoop and band iron used for other purposes, but statistics are not available.

Materials.—The raw material for hoops and bands is iron or steel billets, which are frequently produced in the same plant from iron or steel ingots. The conditions of supply of raw materials is the same as that in other branches of the iron and steel industry.

Methods of production.—Practically the entire domestic production comes from large plants where the billets are reduced to size by continuous rolling. The process is practically identical with that used for the production of steel bars and described in the survey on that subject. American rolling-mill practice is highly standardized and the United States has led the rest of the world in the adoption of labor-saving equipment and in organization for economical production.

Organization.—Hoops and bands are generally made in this country in plants which produce other rolled products. According to the Federal census there were 17 establishments engaged in the manu-

[1] See survey on cotton ties.

facture of hoops, bands, and cotton ties in 1914. The A B C of Iron and Steel (1917) lists nine manufacturers of hoops and 16 manufacturers of bands in the United States. All but two of the hoop manufacturers also manufacture bands. Most of the establishments are located in Pennsylvania and Ohio.

Domestic production and consumption.—The trade statistics indicate that the domestic production is considerably in excess of domestic consumption. In the latter part of the war period the excess of exports over imports largely increased. While the exports decreased slightly after the signing of the armistice, they were from five to ten times the prewar average while imports have become almost negligible in amount.

Production figures are not available but the output of hoops and bands and cotton ties forms a basis for estimating the minimum production figures since these products are made from hoop, band, and scroll iron and consume practically the entire output. The statistics of the production of the manufactured products are, therefore, included in this survey. The figures furnished by the American Iron and Steel Institute differ somewhat from the census figures, in which the same classification is adopted. According to the census, the output of hoops, bands, and cotton ties from steel works and rolling mills in the United States in 1914 was 603,940 gross tons, valued at $19,945,078. The Iron and Steel Institute compilation gives 556,947 gross tons as the output for that year. The census figures for 1909 were 341,043 tons, valued at $10,429,681; and for 1904, 337,223 tons, valued at $12,760,010.

Domestic exports.—In 1910 exports of hoop, band, and scroll iron and steel amounted to 11,734,506 pounds, valued at $259,924. By 1913 they had risen to 41,019,908 pounds, valued at $798,914. During the next two years exports were lower both in quantity and value, but in 1916 they rose to 92,213,153 pounds, valued at $2,448,022. In 1917 they were larger still and in 1918 rose to 131,671,558 pounds, valued at $8,634,217.

Of these exports more went to Canada in each year from 1910 to 1918 than to any other country, Canada receiving 9,235,137 pounds out of a total of 11,734,506 exported in 1910, and 32,004,044 pounds out of a total of 131,671,558 pounds exported in 1918. During the years of heavy exports, 1916–1918, the leading countries were Canada, British India, England, Portugal, China, Japan, and Argentina. Exports in 1919 (calendar year) amounted to 113,871,668 pounds.

FOREIGN PRODUCTION.

Leading foreign producers are England, Germany, France, Sweden, and Belgium.

IMPORTS.

Imports in recent years have been very small compared with exports. Since 1915 imports have averaged less than $1,000 a year in value, as compared with the millions of dollars' worth of exports during the war years. The greatest imports in any year since 1907 were in 1911, when they were valued at $315,540. The quantity of all classes of imports in that year was not stated in Commerce and Navigation. The greatest quantity of imports stated in any year

since 1907 was 4,683,956 pounds, or but little more than 2,000 tons in 1912. Imported raw material, therefore, could have been used to produce only an insignificant part of the 603,940 tons of hoops, bands, and cotton ties produced in the United States in 1914. Details of the imports from 1907 to 1920 are given on pp. 131 to 135. For the calendar year 1919 imports aggreated 64,738 pounds.

PRICES.

The price of steel hoops in Pittsburgh on August 10, 1920, was 5.50 cents per pound and on August 12, 1919, 3.05 cents per pound.

The average value per pound of ungalvanized hoop, band, or scroll iron imported in 1920 was 8.2 cents and in 1919, 9.6 cents.

In 1914 the average value per pound of the ungalvanized hoop, band, or scroll iron imported was 1.6 cents and the average value of the galvanized hoop, band, or scroll iron imported was 3.2 cents. In 1915 the average value per pound of the ungalvanized was 1.3 cents and of the galvanized 3.2 cents. These two years are taken for purposes of comparison of prices because in both these years considerable quantities of both the galvanized and the ungalvanized were imported.

TARIFF HISTORY.

By the act of 1894 hoop, band, or scroll iron was made dutiable at 30 per cent ad valorem. If galvanized, it was dutiable at 30 per cent plus one-fourth cent per pound.

By the act of 1897 hoop, band, or scroll iron or steel, valued at 3 cents per pound or less, 8 inches or less in width, and less than three-eighths of an inch thick and not thinner than No. 10 wire gauge, was made dutiable at five-tenths of 1 cent per pound; thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge, at six-tenths of 1 cent per pound; thinner than No. 20 wire gauge, at eight-tenths of 1 cent per pound. On galvanized hoop iron the rates of duty were two-tenths of 1 cent per pound in addition to the foregoing. Barrel hoops of iron or steel and hoop or band iron or steel, flared, splayed, or punched, were made dutiable at one-tenth of 1 cent per pound more than the material from which they were made.

By the act of 1909 the rates were slightly reduced to three-tenths, four-tenths and six-tenths cent per pound, respectively, for the three sizes as specified above. The extra one-tenth of 1 cent per pound was retained on barrel hoops, etc. Bands and strips of steel, exceeding 12 feet in length, not specially provided for, were made dutiable at 35 per cent ad valorem. The additional two-tenths of 1 cent per pound was retained on galvanized hoop, band, or scroll iron.

By the act of 1913 a flat ad valorem rate of 10 per cent was substituted for the specific duties on hoop, band, or scroll iron or steel and barrel hoops of iron or steel, not galvanized, and an ad valorem rate of 15 per cent on hoop, band, or scroll iron, galvanized.

On strips of iron or steel, cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, an additional duty of four-tenths of 1 cent per pound was provided by the act of 1909 and an additional duty of 1 cent per pound by the act of 1897 above the duty provided for strips of common or black finish of the corresponding gauge or value.

COMPETITIVE CONDITIONS.

Hoop, band, or scroll iron or steel being a simple product of the rolling mill made of material that is cheaper in the United States than in competing countries, and produced on a scale large enough to permit the economies of machine production, American manufacturers of this product are in a strong competitive position. That they are more than able to meet foreign competition in the domestic market is indicated by the fact that exports have been much greater than imports since 1913.

TARIFF CONSIDERATIONS.

Hoop or band iron, or hoop or band steel, cut to lengths, or wholly or partly manufactured into hoops or ties, coated or not coated with paint or any other preparation, with or without buckles or fastenings, for baling cotton or any other commodity, dutiable by the act of 1909 at 0.3 cent per pound, and by the act of 1897 at 0.5 cent per pound, was put on the free list by the act of 1913. The manufactured product is accordingly admitted free while the material of which it is made is dutiable at 10 per cent ad valorem.

Hoop, band, or scroll iron or steel, galvanized or not—Production in United States.

[From annual statistical report of the American Iron and Steel Institute.]

	1913	1914	1915	1916	1917	1918	1919
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Hoops	280,886	211,028	281,759	368,164	347,186	262,281	233,336
Bands and cotton ties	499,660	345,919	437,987	562,555	490,893	250,767	352,172
Total	780,546	556,947	719,746	930,719	838,079	513,048	585,508

Hoop, band, or scroll iron or steel not otherwise provided for, valued at 3 cents per pound or less, 8 inches or less in width and less than three-eighths inch thick, not thinner than No. 10 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ cent per pound	207,772	$3,479.00	$1,038.88	$0.017	29.85
1908	do	309,373	7,279.00	1,546.88	.023	21.25
1909	do	2,211,584	31,489.00	11,057.93	.014	35.12
1910 [4]	$\frac{3}{10}$ cent per pound	248,817	3,123.00	746.46	.013	23.90
1911	do	533,452	8,977.00	1,600.36	.017	17.83
1912	do	2,597,723	39,313.00	7,793.18	.015	19.82
1913	do	87,684	1,112.00	263.05	.013	23.65
1914 [5]	do	438,757	7,436.00	1,316.28	.017	17.70

[4] Aug. 6, 1909, to June 30, 1910, under act of 1909. [5] July 1 to Oct. 3, 1913, under act of 1909.

Hoop, band, or scroll iron or steel not otherwise provided for, valued at 3 cents per pound or less, 8 inches or less in width and less than three-eighths inch thick, thinner than No. 10 and not thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	⅛ cent per pound.	3,561	$95.90	$21.37	$0.027	22.28.
1910 [1]	⅛ cent per pound.	126,433	1,883.00	505.73	.015	26.86.
1911	....do....	10,827	242.00	43.31	.022	17.90.
1912	....do....	72,163	841.20	298.65	.012	34.31
1913	....do....	779,164	9,139.00	3,116.66	.012	34.10.
1914 [2]	....do....	9,116	111.00	36.46	.012	32.85.

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909. [2] July 1 to Oct. 3, 1913, under act of 1909.

Hoop, band, or scroll iron or steel not otherwise provided for, valued at 3 cents per pound or less, 8 inches or less in width and less than three-eighths inch thick, thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	⅛ cent per pound.	129,753	$3,769.00	$1,038.02	$0.029	27.54.
1908	....do....	39,721	1,179.00	317.76	.03	26.95.
1909	....do....	12,424	366.00	99.39	.029	27.16
1913	⅛ cent per pound.	38,369	798.00	230.21	.021	28.85.

Hoop, band, or scroll iron or steel, not specially provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	10 per cent	1,035,518	$16,961.00	$1,696.10	$0.016	10.00.
1915	....do....	574,469	7,289.00	728.90	.013	10.00
1916	....do....	2,000	24.00	2.40	.012	10.00.
1917	....do....	15,200	538.00	53.80	.035	10.00
1918	....do....	3,767	227.00	22.70	.060	10.00
1919	....do....	73,289	7,070.00	707.00	.096	10.00
1920	....do....	7,606	621.00	62.10	.082	10.00.

[1] Oct. 4, 1913 to June 30, 1914, under act of 1913.

Hoop, band, or scroll iron or steel, not specially provided for, galvanized or coated with zinc, spelter, or other metals, or any alloy of these metals—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914	15 per cent	156,458	$4,971.00	$745.00	$0.032	15.00.
1915	....do....	101,414	3,243.00	484.00	.032	15.00
1916	....do....	268,210	7,343.00	1,101.00	.025	15.00
1917	....do....	200	8.00	1.00	.040	15.00
1918	....do....	66,346	1,725.00	258.00	.026	15.00
1919	....do....	5,774	582.00	80.00	.101	15.00.

Hoop, band, or scroll iron or steel (excepting tin plates, terne plates, and taggers tin) galvanized or coated with zinc or spelter or other metals or any alloy of these metals, not thinner than No. 10 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
[illegible]	$\frac{1}{10}$ cent per pound..	71,125	$1,429.00	$497.88	$0.02	34.84
[illegible]	$\frac{1}{10}$ cent per pound..	219,658	2,835.00	1,098.00	.013	38.74

Hoop, band, or scroll iron or steel (except tin plates, terne plates, and taggers tin) galvanized, or coated with zinc or spelter, or other metals, or any alloy of these metals, thinner than No. 10 and not thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
[illegible]	$\frac{1}{10}$ cent per pound..	40,897	$1,477.00	$327.00	$0.036	22.19
[illegible]	.....do.....	1,465	280.00	11.00	.191	4.19
[illegible]	.....do.....	10,114	256.00	80.00	.025	31.60
[illegible]	.....do.....	1,459	101.00	26.00	.069	26.00

Hoop, band, or scroll iron or steel (except tin plates, terne plates, and taggers tin) galvanized or coated with zinc or spelter, or other metals, or any alloy of these metals, thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
[illegible]	1 cent per pound..	49,025	$4,599.00	$490.25	$0.094	10.66
[illegible]	.....do.....	818	132.00	8.00	.161	6.20
[illegible]	.....do.....	2,745	278.00	27.00	.101	9.87
[illegible]	$\frac{1}{10}$ cent per pound..	1,767	46.00	14.00	.026	30.30
[illegible]	.....do.....	100	3.00	.80	.030	26.67

Hoop or band iron, or hoop or band steel, flared, splayed, or punched, with or without buckles or fastenings, and barrel hoops of iron or steel—Not thinner than No. 10 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
[illegible]	$\frac{1}{10}$ cent per pound.	10,120	$390	$60	$0.039	15.56
[illegible]	.....do.....	213	4	1	.019	32.00
[illegible]	$\frac{1}{10}$ cent per pound.	67,800	922	271	.013	29.41

Hoop or band iron, or hoop or band steel, flared, splayed, or punched, with or without buckles or fastenings, and barrel hoops of iron or steel—Thinner than No. 10 and not thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				Per cent.
1909	1/10 cent per pound.	7,337	$183	$51	$0.025	28.07

Hoop or band iron, or hoop or band steel, flared, splayed, or punched, with or without buckles or fastenings, and barrel hoops of iron or steel—Thinner than No. 20 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				Per cent.
1908	1/8 cent per pound.	3,770	$298.00	$33.00	$0.089	11.38
1909	do	41	2.00	.37	.049	18.50
1910	1/8 cent per pound	365	22.00	2.00	.060	11.64

Bands or strips of steel, suitable for making band saws, untempered—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				Per cent.
1907	3 cents per pound and 20 per cent.	33,621	$3,602.00	$1,729.03	$0.107	48.00
1908	do	601,670	59,401.00	29,930.00	.099	50.38
1909	do	698,135	67,419.00	34,427.00	.097	51.07
1910	do	164,018	16,374.00	8,195.00	.100	50.05

Bands or strips of steel, suitable for making band saws, tempered or tempered and polished—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				Per cent.
1907	6 cents per pound and 20 per cent.	82,715	$11,589.00	$7,280.70	$0.14	62.82
1908	do	64,764	9,473.00	5,780.00	.146	61.02
1909	do	40,457	5,937.00	3,614.00	.147	60.89
1910	do	6,701	1,096.00	621.00	.164	56.68

Bands and strips of steel, exceeding 12 feet in length, not specially provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				Per cent.
1910	35 per cent		$195,908	$68,567		35.00
1911	do		250,820	87,787		35.00
1912	do	1,780,875	166,747	58,361	$0.094	35.00
1913	do	3,218,734	222,460	77,861	.069	35.00
1914	do	477,313	37,729	13,205	.079	35.00

Bands and strips of steel, exceeding 12 feet in length, not specially provided for, cold-rolled, smoothed only, not polished—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1911	$\frac{1}{10}$ cent per pound plus 35 per cent.	38,001	$9,004	$3,227	$0.237	35.84
1912	do	2,134	279	101	.131	36.53

Bands and strips of steel, exceeding 12 feet in length, not specially provided for, cold-rolled, cold-hammered, blued, brightened, tempered or polished, by any process to such perfected surface finish or polish better than the grade of cold-rolled, smoothed only—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1909	$\frac{1}{10}$ cent per pound plus 35 per cent.	75,317	$16,039	$5,914	$0.213	36.88
1911	do	230,758	46,497	17,197	.201	36.99
1912	do	219,495	46,130	17,023	.210	36.90
1913	do	364,416	66,652	21,785	.183	37.19
1914	do	121,932	20,023	7,495	.164	37.44

Bands and strips of steel, exceeding 12 feet in length, not specially provided for, galvanized or plated with zinc or spelter or other metals, or any alloy of these metals—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910	$\frac{1}{10}$ cent per pound plus 35 per cent.	8,955	$747	$279	$0.083	37.39
1912	do	11,466	728	277	.063	38.15
1914	do	14,259	905	345	.063	38.15

Hoop, band, and scroll iron and steel—Domestic exports (fiscal years).[1]

Exported to—[2]	1910		1912	
	Pounds.	Value.	Pounds.	Value.
England			89,600	$1,600
Canada	9,235,137	$230,655	14,412,323	281,946
Argentina	407,540	12,317	1,158,075	19,614
Brazil	98,098	3,677	75,196	1,613
Chile	72,225	1,859	141,029	3,441
China	165,099	5,525	721,077	19,133
British India	785,164	13,251	308,212	5,320
Straits Settlements	10,250	456	.....	.....
Other British East Indies	2,775	122	.....	.....
Dutch East Indies	17,859	399	.....	.....
Japan	.....	.....	543,250	14,352
British South Africa	385,107	8,710	81,230	1,535
All other	555,261	12,953	924,742	16,970
Total	11,734,506	259,924	18,453,734	365,524

[1] The year 1911 was included in "All other manufactures of."

[2] The countries selected are those to each of which exports in some one year, 1913-1918, exceeded $100,000 in value.

Hoops, band, and scroll iron and steel—Domestic exports (fiscal years)—Conti

Exported to—	1913		1914		1915	
	Pounds.	Value.	Pounds.	Value.	Pounds.	
Norway					17,830	
Portugal					527,180	
England					874,388	
Canada	18,872,622	$376,561	18,314,269	$376,999	14,229,817	
Argentina	2,035,568	35,767	291,302	5,455	3,151,631	
Brazil	225,105	5,394	289,514	5,528	185,032	
Chile	13,844	499	8,098	325	277,724	
Uruguay					397,506	
China	2,362,650	42,449	849,750	19,904	1,373,139	
British India	13,068,222	240,137	4,041,013	78,953	5,642,484	
Straits Settlements	96,232	2,427	49,995	1,605	336,043	
Other British East Indies					82,510	
Dutch East Indies	27,565	643	21,970	492	33,830	
Japan	77,154	1,761	38,935	1,449	856,846	
Australia	123,403	2,173			2,421,430	
British South Africa	1,245,522	25,479	281,566	6,914	705,572	
All other	2,872,021	65,624	1,589,277	31,029	2,704,269	
Total	41,019,908	798,914	25,775,689	528,653	33,817,231	

Exported to—	1916		1917		1918	
	Pounds.	Value.	Pounds.	Value.	Pounds.	
France	231,260	$6,315	1,232,616	$63,201	2,177,843	
Norway	29,126	677	7,455,534	311,602	2,312,040	
Portugal	10,293,603	252,929	5,647,000	188,598	11,120,059	
England	16,001,981	185,035	10,726,351	508,722	3,457,422	
Canada	23,572,758	654,689	25,841,536	1,188,519	32,004,044	
Argentina	2,457,710	58,973	7,245,339	259,379	10,396,596	
Brazil	226,977	11,621	1,221,412	66,566	1,852,619	
Chile	594,248	14,532	908,722	47,007	2,141,518	
Uruguay	1,057,238	18,884	1,133,702	49,881	3,167,811	
China	3,300,410	91,219	5,915,245	235,866	7,308,877	
British India	15,655,866	370,717	15,633,039	604,019	18,793,924	
Straits Settlements	534,267	18,608	1,668,752	107,407	3,213,196	
Other British East Indies	371,147	9,217	527,795	26,105	2,275,867	
Dutch East Indies	189,376	6,260	672,822	47,910	2,427,898	
Japan	3,524,027	94,082	6,154,164	244,485	12,573,874	
Australia	2,994,461	65,487	3,478,565	141,845	2,669,791	
British South Africa	1,461,902	35,670	647,846	33,457	1,730,660	
All other	9,635,856	553,077	11,450,922	459,108	12,047,519	
Total	92,213,153	2,448,022	107,651,362	4,673,677	131,671,558	

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.	Value.	Pounds.	
France	507,857	$125,142	1,995,747	
Norway	6,318,140	437,087	1,645,880	
Portugal	17,792,117	1,146,166	4,916,461	
England	207,558	17,240	5,273,810	
Canada	26,211,313	1,296,271	20,327,174	
Argentina	7,335,967	401,558	8,118,340	
Brazil	1,027,788	142,821	3,155,996	
Chile	1,508,314	108,524	3,018,912	
Uruguay	2,296,439	163,750	2,756,366	
China	7,022,071	437,385	5,473,856	
British India	13,710,885	1,073,064	21,849,984	1,
Straits Settlement	2,718,511	281,689	1,255,306	
Other British East Indies	3,119,821	209,552	1,818,743	
Dutch East Indies	2,365,608	209,094	3,216,797	
Japan	8,301,594	667,823	9,746,995	
Australia	2,917,456	260,949	5,539,316	
British South Africa	833,169	64,533	2,236,574	
All other	8,713,989	584,547	11,525,411	
Total	113,508,597	7,711,195	113,871,668	6,

Hoops, prices, monthly averages, Pittsburgh, Pa.

[From Metal Statistics.]

Month.	1912	1913	1914	1915	1916	1917	1918	1919
January	$1.28	$1.55	$1.25	$1.24	$2.04	$3.50	$3.50	$3.30
February	2.25	1.60	1.30	1.25	2.40	3.75	3.50	3.30
March	1.25	1.60	1.30	1.25	2.57	4.00	3.50	3.21
April	1.25	1.60	1.25	1.25	2.70	4.00	3.50	3.05
May	1.25	1.60	1.25	1.25	2.88	4.00	3.50	3.05
June	1.27	1.60	1.25	1.25	2.75	4.75	3.50	3.05
July	1.36	1.55	1.27	1.30	2.75	5.50	3.50	3.05
August	1.40	1.55	1.28	1.33	2.87	5.48	3.50	3.05
September	1.50	1.60	1.30	1.43	3.00	5.00	3.50	3.05
October	1.50	1.55	1.27	1.55	3.03	5.00	3.50	3.05
November	1.50	1.45	1.25	1.77	3.25	4.04	3.50	3.05
December	1.50	1.40	1.23	1.95	3.33	3.50	3.38	3.05
Average	1.36	1.55	1.27	1.40	2.80	4.38	3.49	3.11

Bands, hoops, and ties, prices, annual averages, season prices cotton ties per bundle, 45 pounds, all Pittsburgh, Pa.

[From Metal Statistics.]

Year.	Bands.	Hoops.	Ties.	Year.	Bands.	Hoops.	Ties.
1902	$1.60	$1.90	$0.80	1912	$1.25	$1.36	$0.70
1903	1.53	1.84	.85	1913	1.38	1.55	.80
1904	1.31	1.48	.75	1914	1.15	1.27	.65
1905	1.48	1.65	.85	1915	1.31	1.40	.85
1906	1.50	1.88	.85	1916	2.48	2.80	1.35
1907	1.60	2.00	.95	1917	3.49	4.38	2.10
1908	1.50	1.90	.85	1918	[1] 3.14	3.49	2.10
1909	1.30	1.56	.70	1919	3.11	3.11	1.70
1910	1.42	1.54	.75	1920	4.57	4.57	2.00
1911	1.28	1.40	.75				

[1] Computed on card ruling to May 21, 1918.

Court and Treasury Decisions.

The provision in the Revised Statutes for band, hoop, and scroll iron was construed not to include bands or hoops of iron cut to lengths and accompanied with buckles for cotton ties, which were classified as manufactures of iron, n. s. p. f. (Badger *v.* Ranlett, 106 U. S., 255).

Steel hoop bands 21 and 22 gauge, $\frac{7}{8}$ and $\frac{1}{4}$ inch wide, respectively, and put up in coils 125 feet in length, were held dutiable as hoop steel under paragraph 128 of the act of 1897 and not as hoop or band steel cut to lengths for baling cotton or other commodity under paragraph 129. (G. A. 5714; T. D. 25406.)

Hoop or band iron or steel cut to lengths which can be identified as cotton ties was held exempt from duty under paragraph 509 of the act of 1913, and dutiable under paragraph 107 if not so identified. No. 9 annealed wire was declared not wire for baling hay or other commodities. The appraiser reported that the standard cotton tie is about $\frac{7}{8}$ inch in width by 19 Birmingham wire gauge (0.042 inch) in thickness and 11½ feet long; that it weighs approximately 1½ pounds, so that every bale of cotton has a recognized standard tare; that when put upon the market each tie is fitted with a buckle, and that they are put up in bundles of 30 ties each. (Dept. Order, T. D. 34055.)

See Survey on cotton ties.

Hoop, band, or scroll iron or steel, galvanized or not—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	154	Hoop, or band, or scroll, or other iron, 8 inches or less in width, and not thinner than No. 10 wire gauge.	1 cent per pound.
		Thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge.	1 1/10 cents per pound.
		Thinner than No. 20 wire gauge	1 2/10 cents per pound.
	177	* * * bands, hoops, strips, and sheets of all gauges and widths. * * * all of the above classes of steel not otherwise specially provided for in this act, valued at 4 cents a pound or less.	45 per cent ad valorem.
		Above 4 cents a pound and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 1/2 cents per pound.
		Valued at above 10 cents per pound	3 1/2 cents per pound.
		Provided, * * * on all iron or steel strips * * * cold rolled, cold hammered or polished in any way in addition to the ordinary process of hot rolling or hammering, there shall be paid one-fourth cent per pound, in addition to the rates provided in this act. * * *	
1890	140	Hoop, or band, or scroll, or other iron or steel, valued at 3 cents per pound or less, 8 inches or less in width, and less than three-eighths of 1 inch thick and not thinner than No. 10 wire gauge.	1 cent per pound.
		Thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge.	1 1/10 cents per pound.
		Thinner than No. 20 wire gauge	1 2/10 cents per pound.
1890	143	* * * all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plate, terne plates, and taggers tin, and hereinafter provided for, when galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals, shall pay three-fourths of 1 cent per pound more duty than the rates imposed * * * upon the corresponding gauges or forms, of common or black sheet or taggers iron or steel.	
	152	* * * on all strips * * * of iron or steel * * * which are cold rolled, cold hammered, blued, brightened, tempered or polished by any process to such perfected surface finish, or polish better than the grade of cold rolled, smooth only, hereinbefore provided for, there shall be paid 1 1/4 cents per pound in addition to the rates provided in this act upon * * * strips * * * of iron or steel of common or black finish.	
1894	116	Hoop, band, or scroll iron or steel, except as otherwise provided for in this act.	30 per cent ad valorem.
	119	* * * all hoop, band or scroll iron or steel, excepting what are known commercially as tin plates, terne plates, and taggers tin, and hereinafter provided for, when galvanized or coated with zinc or spelter, or other metals, or any alloy of those metals shall pay one-fourth of 1 cent per pound more duty than the rates imposed * * * upon the corresponding gauges * * * of common or black sheet or taggers iron or steel.	
1897....	128	Hoop, band, or scroll iron or steel, not otherwise provided for in this act, valued at 3 cents per pound or less, 8 inches or less in width, and less than three-eighths of 1 inch thick and not thinner than No. 10 wire gauge.	1/10 cent per pound.
1897....	128	Thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge.	1/5 cent per pound.
		Thinner than No. 20 wire gauge	1/5 cent per pound.
	132	* * * all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates, terne plates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals, shall pay two-tenths of 1 cent per pound more duty than if the same was not so galvanized or coated.	
	141	* * * on all strips * * * of iron or steel * * * which are cold rolled, cold hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, hereinbefore provided for, there shall be paid 1 cent per pound in addition to the rates provided in this act upon * * * strips * * * of iron or steel of common or black finish.	
1909....	124	Hoop, band, or scroll iron or steel, not otherwise provided for in this section, valued at 3 cents per pound or less, 8 inches or less in width, and less than three-eights of 1 inch thick and not thinner than No. 10 wire gauge.	1/10 cent per pound.
		Thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge.	1/5 cent per pound.
		Thinner than No. 20 wire gauge	1/5 cent per pound.
	128	* * * all hoop, band, or scroll iron or steel, excepting what are known commercially as tin plates, terne plates, and taggers' tin, and hereinafter provided for, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals, shall pay two-tenths of 1 cent per pound more duty than if the same was not so galvanized or coated.	

Hoop, band, or scroll iron or steel, galvanized or not—Rates of duty—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1909....	137	* * * on all strips * * * of iron or steel * * * which are cold-hammered, blued, brightened, tempered, or polished by any process to such perfected surface finish or polish better than the grade of cold rolled, smoothed only, * * * there shall be paid four-tenths of 1 cent per pound in addition to the rates provided in this section upon * * * strips * * * of iron or steel of common or black finish of corresponding gauge or value.	
1913....	107	Hoop, band, or scroll iron or steel not otherwise provided for in this section, * * *.	10 per cent ad valorem.
	109	* * * all hoop, band, or scroll iron or steel, when galvanized or coated with zinc, spelter, or other metals, or any alloy of those metals.	15 per cent ad valorem.

COTTON TIES.

SUMMARY.

Cotton ties in the United States present no tariff problem, as only small quantities have been imported (chiefly from England and Germany) since they were placed on the free list in 1913. The largest importation (1915) amounted to only one and one-half hundredths of 1 per cent, or less, of the total domestic supply.

The domestic industry is in the hands of six manufacturers who control the situation so thoroughly that foreign competition is practically eliminated.

Cotton ties are part of the output of rolling mills making also other products. Two of these mills are located in the Southern States (Alabama and Georgia) and four in Pennsylvania. The combined capitalization of the six establishments is approximately $349,000,000 and the annual output of cotton ties around $2,000,000.

Cotton ties—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption.	Domestic exports.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
		Pounds.	*Pounds.*				*Per cent.*
1910	[2]	499,529	[3] 45,000	$9,389	$1,498.58	$0.019	15.96
1911	.....	54,939	.....	567	164.82	.010	29.07
1912	.....	826,762	.....	15,094	2,480.26	.018	16.43
1913	.....	278,235	.....	5,195	834.70	.019	16.07
1914	.....	[4] 6,107,444	.....	121,611	2,211.43	.018	16.87
1915	.....	2,105,841	.....	32,506	.....	.015	.....
1916	.....	470	.....	28	.....	.059	.....
1917	.....	87,850	.....	2,064	.....	.024	.....
1918	.....	4,600	.....	46	.....	.010	.....

[1] The figures for cotton ties and bands are reported by the American Iron and Steel Institute and are given in Survey on "Hoops, bands and scroll iron and steel," see production tables, supra. Cotton ties are not differentiated from bands.

[2] Estimated annual production is between 90,000,000 and 135,000,000 pounds.

[3] B. E. V. Luty, manager, "The American Metal Market Co." in letter of July 29, 1918; also J. T. Rose, in tariff hearings, H. R. Doc. No. 1447, p. 1081.

[4] Reported by exporters. Aux. file.

[5] Includes 5,370,302 pounds free under the act of 1913; amount of duty, value per unit and equivalent ad valorem rates are shown for the dutiable imports only.

GENERAL INFORMATION.

TARIFF ACT OF 1913.

PAR. 509. Hoop or band iron, or hoop or band steel, cut to lengths, or wholly or partly manufactured into hoops or ties, coated or not coated with paint or any other preparation, with or without buckles or fastenings, for baling cotton or any other commodity. Free.

DESCRIPTION.

The cotton tie used in the United States is a strip of steel fifteen-sixteenths of an inch wide, by thirty-five one-thousandths inch thick (20 gauge), and 11½ feet long. With each tie is a flat steel buckle, rectangular in shape, with a rectangular opening punched out of the middle and an opening at one side. The end of the tie is bent back after being passed through this buckle and is held in this way. Six ties are required for each bale of cotton at the gin, and when the bale is compressed to a smaller size the ties are cut and riveted together to make seven or eight, the same weight of ties being used on both square and compressed bales. Each tie weighs 1½ pounds; there are 9 pounds of steel ties on each bale.

Cotton ties are used almost exclusively for tying bales of cotton, and after having been once used may be rerolled and used again.

DOMESTIC PRODUCTION.

Cotton tie production is governed by the cotton crop to be baled. One bundle of ties contains 30 bands and 30 buckles, which are sufficient to cover five bales of cotton. The domestic cotton crop requires between 2,500,000 and 3,000,000 bundles of ties, and the annual production has been estimated[1] roughly at these figures.

Materials.—Steel billets, the principal raw material, are usually made by the concern manufacturing cotton ties. When purchased they are ordinarily obtained from domestic steel manufacturing plants. Foreign billets are admitted free of duty.

Equipment.—Any rolling mill equipped to roll hoops, bands or strips of iron or steel can make cotton ties.

Methods of production.—Steel billets are rolled into strips $\frac{15}{16}$ inch wide and $\frac{35}{1000}$ inch thick. The strips are cut into 11½ foot lengths and tied in bundles of 30, weighing 45 pounds. Buckles are put on, or inclosed in the bundle at the time of tying it, and the bundle is then dipped into cotton-tie varnish, to prevent rust. This operation of manufacture is standard.

Organization.—The making of cotton ties is not an industry in itself, but this product is part of the output of rolling mills making also hoops, wire nails, smooth wire, barbed wire, woven wire fence, bars, spikes, and similar products. Ties are not made by all mills whose equipment would enable them to do so, but the industry is confined to six plants. Two of these plants, which make most of the domestic ties, besides a large variety of other iron and steel products, belong to the United States Steel Corporation. The six plants, in which cotton ties are one of the products, have a combined capitalization of approximately $349,000,000.

Geographical distribution.—Two factories are located in the Southern States—the cotton region and logical market of cotton ties in this country, one of which is at Atlanta, Ga., and the other at Helena, Ala. The other factories are located in the State of Pennsylvania.

Domestic production and consumption.—It is estimated that between 2,000,000 and 3,000,000 bundles of 45 pounds each are produced

[1] Estimated by B. E. V. Luty, manager the American Metal Market Co., in letter of July 29, 1918; also by I. T. Rose, tariff hearings, H. R. Doc. No. 1447, p. 1081.

annually in the United States (p. 141). At 75 cents per bundle, the average price during the six-year period preceding the war, 1910–1915 (p. 146), the estimated production would amount in value to between $1,500,000 and $2,250,000.

The demand for and sale of cotton ties is seasonal, extending over a period of only three months, beginning with May of each year. During the remainder of the year the production is stored in warehouses.

Only small quantities are exported (imports also are insignificant, amounting in 1915 to only one and one-half-hundredths of 1 per cent, or less, of the total supply), indicating that most of the domestic production is consumed at home.

Domestic manufacturing facilities are amply sufficient for supplying the home demand.

Domestic exports.—Statistics of cotton ties manufactured from domestic material are not separately compiled by the Government; these figures are included in the published figures for hoop, band, and scroll iron and steel. The export movement of ties, however, is small and irregular, depending largely upon the cotton crop. Mexico, India, and China are the principal markets. Exporters report shipments of 10,000 bundles to foreign countries in 1914.

FOREIGN PRODUCTION.

England and Germany have been the largest foreign producers of cotton ties. It is stated by J. T. Rose, second vice president, Atlanta Steel Co., that England makes practically all the ties for Egyptian cotton.[1]

Roughly estimated, the United States produces practically two-thirds of the world's cotton crop. It also consumes in baling the cotton two-thirds of the world's cotton-tie output, inasmuch as cotton ties find little use other than for baling cotton. Figuring on this basis the cotton-tie production of all foreign countries combined would be, approximately, only one-third of the world's total.

IMPORTS.

Beginning with the year 1915 figures are published by the Department of Commerce for imports by countries of "Hoop or band iron or steel for baling," which includes cotton ties. These figures show that in 1915 there was imported 1,416,538 pounds, all of which came from England. On account of war conditions imports from all European countries ceased after that year, and only small quantities were received from Canada (p. 145). The 1915 importations were received mostly at Galveston, Tex.

[1] Tariff Hearings, H. R. Doc. No. 1447, p. 1082.

Imports of hoop or band iron or steel for baling, during the fiscal year 1915.

[From U. S. Commerce and Navigation.]

Received at—	From—	Quantity.	Value.	Average value per pound.	Average value per bundle of 45 pounds.
		Pounds.		*Cents.*	*Cents.*
Philadelphia	England	123,142	$1,874	1.52	68.48
Galveston	do	1,293,396	20,678	1.59	71.94
Total and average		1,416,538	22,552	1.59	71.64

Prior to 1915 cotton ties were also received from Belgium and Germany. Only newly manufactured ties are imported.

Figures of total imports for consumption of "Hoop or band iron, or hoop or band steel, cut to lengths or wholly or partly manufactured into hoops or ties, coated or not coated with paint or any other preparation, with or without buckles or fastenings for baling cotton or any other commodity" were published by the United States Department of Commerce prior to the fiscal year 1914. During the three-year period 1911 to 1913 these annual imports varied from 54,939 pounds (equal to 1,221 bundles of 45 pounds each) in 1911 to 826,762 pounds (equal to 18,372 bundles) in 1912 the average annual imports for the period being 386,645 pounds (equal to 8,592 bundles) (p. 146).

PRICES.

The market for cotton ties is seasonal, extending over only about three or four months of the year. The price is announced usually about May of each year and it has always been 35 cents per 100 pounds higher than the base price (in May) of hoops. They are sold in bundles of 30 ties weighing 45 pounds per bundle. During the time of peace the price varied but little from one season to another; thus, during the 10 years preceding the war, from 1906 to 1915, the average annual price per bundle at Pittsburgh, Pa., ranged from 95 cents in 1907 to 65 cents in 1914; the average for the 10-year period being 78½ cents. The average annual price rose to $1.35 in 1916 and to $2.10 in 1917 as a result of war conditions (p. 146).

The price in the cotton belt of the United States has been about 24 cents higher than the Pittsburgh price (H. R. Doc. No. 1447, p. 1087).

In 1915 the average price at Pittsburgh was 85 cents. The import price of hoop or band iron or steel for baling, received from England at Philadelphia in 1915 averaged 68½ cents, and at Galveston 72 cents per bundle of 45 pounds. (See above table.)

Prices f. o. b. ship at Hamburg are said to be about the same as those quoted at Pittsburgh (H. R. Doc. No. 1447, p. 1235).

TARIFF HISTORY.

The tariff act of 1894, in accordance with the policy of a general reduction in import duties, removed the duty on cotton ties. During the first year of the operation of this act (1895) imports amounted to 111,000 pounds, and two years later (1897, the last year of the act)

to 16,265,506 pounds. The large import in 1897 was no doubt influenced by the consideration, in Congress, of the tariff act passed that year which placed a duty on cotton ties of 5/10 cent per pound. After the passage of the 1897 act no imports are recorded until the fiscal year 1900, and during the life of the act imports ranged from a little over 500,000 to nearly 5,000,000 pounds annually. The act of 1909 reduced the duty to 3/10 cent per pound. This reduction did not result in increased imports; in fact, the quantities in general were smaller, ranging from 55,000 to 825,000 pounds annually during the life of the act. The act of 1913 placed cotton ties on the free list. Imports under the 1913 act were irregular and, in general, show large decreases after 1915.

COMPETITIVE CONDITIONS.

There are six establishments manufacturing cotton ties in the United States; two of these are located in the cotton-raising section of the country and the others in Pennsylvania. These factories are capable of supplying the domestic needs. Foreign ties have come to the United States, chiefly from England and Germany, in quantities which have been small when compared to the domestic production and have offered competition of only minor importance.

Foreign ties are sold c. i. f., the freight being paid by the shipper, and rates are difficult to obtain as bills of lading do not show them. However, the freight rate from Liverpool to New Orleans quoted in 1913 amounted to about 11 cents per 100 pounds. For many years it was the practice of vessels to bring over cotton ties as ballast and very low freight rates were made. More recently the ties have come in as part of general cargoes.

In 1919, the rail rate on cotton ties, per 100 pounds in carload lots, from Pittsburgh to New Orleans was 31½ cents, to Charleston, S. C., and Savannah, Ga., 40 cents, and to Jacksonville, Fla., 42½ cents.

Mr. J. T. Rose of the Atlanta Steel Co., in a hearing before the House Ways and Means Committee in connection with the 1913 tariff act, claimed that Germany with its low transportation costs could deliver cotton ties at the southern ports—Charleston, Savannah, and Jacksonville—at a transportation cost less than one-half that from the Pittsburgh district to these points (H. R. Doc. No. 1447, p. 1087).

Mr. James Brown, trustee, Southern Iron & Steel Co., at the above hearing (p. 1235) stated that cotton ties could be shipped from Liverpool, Manchester, Hamburg, or Bremen at mere nominal or ballasting freight rates in steamers coming otherwise empty or in water ballast to the South Atlantic or Gulf States for the purpose of loading cotton to the European markets. He stated further, that such freight rates might not exceed $3 or $4 per ton from Hamburg or Bremen to Galveston, as against the rates in this country of $11.20 per ton from Alabama to Texas, while the prices of cotton ties at Hamburg are about the same as those which prevail at Pittsburgh, Pa.

The American mills know each year in advance what the English makers will ask and, as a rule, name a price on ties each year at a figure slightly lower than that at which they can be imported. The United States Steel Corporation, Atlantic Steel Co., and the Connors-Weyman Steel Co. have for many years made all of the ties manufactured in this country.

Very few ties are sold by the manufacturer to the consumer. In the southwest large wholesale grocers generally handle ties and sell to cottonseed-oil concerns and country stores or ginners. Small ginners or farmers who buy ties and bagging in less than carload lots generally buy from a local store or dealer. In the southeast the method of distribution is somewhat different. Wholesale grocers do not handle ties to the extent that these firms do in the southwest. Cottonseed-oil companies and local dealers handle most of the ties in this territory. Dealers in second hand ties sometimes sell direct to the ginner, but this is an exception to the general rule. Most of these ties, as is the case with new ties, are handled by local dealers (Sen. Doc. No. 213, 63d Cong., 1st sess.).

This commodity does not move from one market to another except on direct order, and foreign manufacturers require a signed contract or acceptance accompanied by bank guaranty before they will make up or ship an order for cotton ties to this country.

TARIFF CONSIDERATION.

The importation of cotton ties since they were placed on the free list has been small, and the tariff on this commodity has but slight significance from either the revenue or the protection point of view.

Hoop or band iron or steel for baling—Imports by countries (fiscal years).

Imported from—	1915 [1]		1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
Sweden	[2]	[2]						
England	1,416,538	$22,552						
Canada			[3] 470	$28	[4] 87,850	$2,064		
Danish West Indies							4,600	$46
Total	1,416,538	22,552	470	28	87,850	2,064	4,600	46

[1] Included in "All other manufactures of iron and steel" prior to 1915.
[2] Error in figures in Commerce and Navigation reporting 35,233 pounds, valued at $1,150, as per letter from the collector of customs at Chicago, Mar. 15, 1919.
[3] Steel bands. Not used for baling cotton. See letter of collector of customs, Buffalo (Auxiliary File, p. 9).
[4] Only 54,729 pounds were cotton ties; the rest were bands for barrels. See letter of collector of customs, Seattle and Norfolk (Auxiliary File, p. 10).

Hoop or band iron, or hoop or band steel, cut to lengths, or wholly or partly manufactured into hoops or ties, etc., for baling cotton or any other commodity—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1909	⅛ cent per pound.	716,819	$20,805.00	$3,584.10	$0.029	17.23
1910 [1]	⅛ cent per pound.	499,529	9,389.00	1,498.58	.019	15.96
1911	do	54,939	567.00	164.82	.010	29.07
1912	do	826,762	15,094.00	2,480.26	.018	16.43
1913	do	278,235	5,195.00	834.70	.019	16.07
1914	do	737,142	13,110.00	2,211.43	.018	16.87
	Free	5,370,302	108,501.00		.020	
1915	do	2,105,841	32,506.00		.015	
1916	do	470	28.00		.059	
1917	do	87,850	2,064.00		.024	
1918	do	4,600	46.00		.010	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Cotton ties—Prices, per bundle of 45 pounds at Pittsburgh, Pa.

[From Metal Statistics, 1918.]

1906	$0.85	1911	$0.75	1916	$1.8
1907	.95	1912	.70	1917	2.1
1908	.85	1913	.80	1918	2.1
1909	.70	1914	.65	1919	1.1
1910	.75	1915	.85	1920	2.0

Court and Treasury Decisions.

The provision in the Revised Statutes for band, hoop, and scroll iron was construed not to include bands or hoops of iron cut to length and accompanied with buckles for cotton ties, which were classified as manufactures of iron, n. s. p. f. (Badger *v.* Ranlett, 106 U. S., 255.)

Steel hoop bands, 21 and 22 gauge, seven-eighths and three-fourths inch wide, respectively, and put up in coils 125 feet in length, were held dutiable as hoop steel under paragraph 128 of the act of 1897 and not as hoop or band steel cut to lengths for baling cotton or other commodity under paragraph 129. (G. A. 5714, T. D. 25406.)

Hoop or band iron or steel cut to lengths which can be identified as cotton ties was held exempt from duty under paragraph 509 of the act of 1913 and dutiable under paragraph 107 if not so identified. No. 9 annealed wire was declared not wire for baling hay or other commodities. The appraiser reported that the standard cotton tie is about seven-eighths inch in width by 19 Birmingham wire gauge (0.042 inch) in thickness and 11½ feet long; that it weighs approximately 1½ pounds, so that every bale of cotton has a recognized standard tare; that when put upon the market each tie is fitted with a buckle, and that they are put up in bundles of 30 ties each. (Department order, T. D. 34055.)

Old cotton tie buckles have been held dutiable as manufactures of metal under paragraph 167 of the act of 1913 and not exempt from duty under paragraph 509 (Abstract 37600). In a similar ruling, which was followed, paragraph 459 of the act of 1894 was declared to provide for cotton ties with or without buckles, but not for buckles with or without ties (G. A. 2848, T. D. 15667).

Cotton ties—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883	155	Iron and steel cotton ties, or hoops for baling purposes, not thinner than No. 20 wire gauge.	35 per cent ad valorem.
1890	140	Hoop or band or scroll or other iron or steel, valued at 3 cents per pound or less, 8 inches or less in width, and less than three-eighths of 1 inch thick and not thinner than No. 10 wire gauge.	1 cent per pound.
		Thinner than No. 10 wire gauge and not thinner than No. 20 wire gauge	1⅛ cents per pound.
		Thinner than No. 20 wire gauge	1⅛ cents per pound.
		Provided, That hoop or band iron, or hoop or band steel cut to length, or wholly or partially manufactured into hoops or ties for baling purposes, barrel hoops of iron or steel, and hoop or band iron or hoop or band steel flared, splayed, or punched, with or without buckles or fastenings, shall pay two-tenths of 1 cent per pound more duty than that imposed on the hoop or band iron or steel from which they are made.	
1894	459	Cotton ties of iron or steel cut to lengths, punched or not punched, with or without buckles, for baling cotton.	Free.
1897	129	Hoop or band iron, or hoop or band steel, cut to lengths, or wholly or partly manufactured into hoops or ties, coated or not coated with paint or any other preparation, with or without buckles or fastenings, for baling cotton or any other commodity.	⅛ cent per pound.
1909	125	Same	⅛ cent per pound.
1913	509	Same	Free.

SAWS.

SUMMARY.

In 1914, 100 establishments in the United States were engaged in the manufacture of saws. They employed 4,560 wage earners and produced saws to the value of $12,517,000. The value of the saws produced in 1918 was probably in excess of $25,000,000. The industry is not only of fundamental importance to the lumber and building industry but of great importance to metal working and many other industries. The industry is spread through many States. The leading state is Pennsylvania.

Imports in 1914 were valued at $63,570, the highest figure reached in any year since 1907, and amounted then only to one-half of 1 per cent of domestic production. Exports averaged more than $1,250,000 during the four years 1910–1913, and during the war rose to much higher figures, reaching $4,611,098 in 1917. These exports, both before and during the war, went not only to less developed countries but to highly developed countries, including England, Germany, and France.

The duty on saws ranged from an average of 23.31 to 29.68 per cent during the years 1907 to 1913. It was reduced to a flat ad valorem rate of 12 per cent by the act of 1913.

Saws—Summary table.

Fiscal year.	Domestic production. [1]	Ratio to production. [2]		Value (imports for consumption).	Amount of duty.	Actual or equivalent ad valorem rate.
		Imports.	Exports.			
		Per cent.	*Per cent.*			*Per cent.*
1910	$11,536,000	0.5	7.97	$57,660.93	$14,260.60	24.73
1911				55,156.63	13,400.59	24.30
1912				37,040.42	8,720.76	23.54
1913				45,961.00	10,711.68	23.31
1914	12,517,000	.5	11.78	63,570.30	8,929.72	14.05
1915				47,504.00	5,700.48	12.00
1916				26,135.00	3,136.20	12.00
1917				27,782.00	3,333.84	12.00
1918	[3] 25,000,000	.1	18.28	24,846.00	2,981.52	12.00
1919				15,211.00	1,825.32	12.00
1918				18,473.00	2,216.76	12.00
1919				51,645.00	6,197.40	12.00

[1] Calendar year.
[2] Percentage based on values.
[3] Estimate based on statement of a large manufacturer that production had probably increased 20 per cent in quantity and that prices had increased 80 per cent since 1914. Such increases added to the 1914 production would give $27,000,000.

GENERAL INFORMATION.

1913 TARIFF PARAGRAPH.

PAR. 139. Crosscut saws, mill saws, pit and drag saws, circular saws, steel band saws, finished or further advanced than tempered and polished, hand, back, and all other saws, not specially provided for in this section, 12 per cent ad valorem.

DESCRIPTION.

Crosscut saws are used in felling trees and cutting logs to lengths. They are made for use by either one or two men. *Drag saws* are similar to crosscut saws, but are operated by machinery instead of by hand and are usually used in mills for cutting logs. *Pit saws* are hand saws used for sawing boards directly from the log. *Mill saws* are upright saws operated by machinery and used for rift sawing. The *circular saw* is a disk in shape and used in sawmills and by farmers and others in sawing wood for fuel, for which use it is displacing crosscut saws and bucksaws. *Band saws* are continuous bands run over pulleys and used in sawmills. *Backsaws* have thin blades for fine cutting, with the back stiffened by a thick strip of steel or brass to prevent the blade from buckling. Broadly speaking, the term *handsaws* includes such saws as buck, hack, keyhole, plumbers', back, pruning, and many others, and might include crosscut and pit saws. Generally it signifies only the ordinary carpenter's crosscutting saw, all other saws having special names, whether used by hand or not.

Among the "hand" saws produced by a large American manufacturer may be named crosscut, hand, rip, combination, gauge, flooring, plumbers' miter-box, back, dovetail, compass, keyhole, cabinet, Turkish, joiners', pattern makers', stair builders', coping, pruning, buck, butchers' dehorning, beef-splitter, pork-packer, kitchen, hack, and rail hack saws.

Power-driven saws are also produced in great variety. Among such saws are included many circular saws, as gullet tooth circular, circular miter, shingle, dado head or grooving, edger, resawing or siding, trimmer, slasher, swing cut-off, circular top, and concave saw.

Circular saws are used not only in sawing wood, but also in sawing metals, stone, bone, leather, paper, fiber, rubber, mica, straw, ivory, coal, ice, raisins, cotton, peanuts, hay, and other articles.

Band saws are made in a variety of sizes and with single or double edge.

Cylinder saws are used mainly in cooperage work. This group includes the straight cylinder, the bilge, and the bottom saw. One type of cylinder saw is used in cutting button blanks out of pearl and bone.

DOMESTIC PRODUCTION.

The 1914 census of manufactures reported 100 establishments engaged in manufacturing saws, employing 4,560 wage earners. The product was valued at $12,517,000. Making allowance for the great increase in prices of saws (about 80 per cent) a small increase in volume of output would bring the current value of the output to $25,000,000 or more.[1]

Materials.—The chief raw material is crucible steel. For the best saws this steel must be of a particularly high grade, absolutely free from blowholes, seams, splits, and other defects, and it must be uniform in hardness. Each tooth of a good saw must be sufficiently hard to withstand the wear and retain its sharp edge the longest possi-

[1] Estimate based on statement of Atkins & Co. that prices have risen 80 per cent above 1914 level and quantity produced has probably increased 20 per cent. Such percentages of increase added to the census figures for 1914 would give $27,000,000.

ble time, yet tough enough to swage readily and perfectly without flaw; hard enough to require force to bend it and at the same time so tough that it will bend without strain or fracture. Good saw steel must have tensile strength more than three times as great as is required for boilers, bridges, or buildings. Because of the difficulty encountered in buying suitable steel, some large saw manufacturers produce their own crucible steel, Henry Disston having erected a crucible steel plant as early as 1855. In detail, raw materials include sheet steel, tool steel, strip steel for band saws, lumber for handles, cast iron, malleable iron, and brass for screws. In addition can be included many articles necessary for manufacturing supplies, such as grindstones, leather, rubber, abrasives, oils, etc. Of particular importance are the files required for sharpening. Importations have always been small, and are now very low. Imports in the main have been for quality. One manufacturer of hack-saw blades reports that steel from Sheffield, England, is imported for at least one-third of his output, the reason for such importation being not quality but an advantage gained in the way of duty drawback on exports.

Equipment.—American producers have taken the lead in labor-saving inventions and up-to-date equipment.

Methods of production.—In the larger saw-making establishments, like the Disston or Atkins, the processes are highly standardized and specialized; comparatively few operations are performed by wholly automatic machines, but much use is made of semiautomatic labor-saving devices.

Among the processes in producing a handsaw may be mentioned:

1. Casting the steel into the ingot.
2. Rolling the red-hot ingot into a sheet.
3. Trimming the sheet.
4. Cutting the sheet to form and size.
5. Toothing the blade.
6. Hardening.
7. Tempering.
8. Straightening and flattening.
9. Tensioning.
10. Grinding.
11. Glazing.
12. Blocking.
13. Polishing.
14. Etching.
15. Setting the teeth.
16. Sharpening.
17. Handling up.
18. Inspection.

In these processes much highly skilled and specialized labor is employed.

Organization.—The Census of Manufactures of 1914 reported 100 establishments with 4,560 wage earners engaged in the production of saws. Of these wage earners 40 per cent were employed in one establishment and 76.4 per cent were employed in six establishments, each employing more than 100 wage earners. The capital invested in the industry was, in 1914, $15,860,000, nearly all of which was in the hands of a dozen large producers. The total values of the saws produced was $12,517,000, 87.6 per cent of which was produced by

13 establishments with a capital of $100,000 or more. Establishm with a capital of less than $20,000 numbered 63, and their total out was valued at $421,000, or only 3.4 per cent of the total. Th figures show that the industry is concentrated very largely in hands of a few large concerns. These concerns gain in efficiency standardization of processes and specialization of labor and the us elaborate equipment. The advantages of large-scale production illustrated by one large concern which produces its own crucible st devotes a special department to the manufacture of brass screws the saw handles, manufactures its own handles from logs purcha in carload lots, and has developed a large file industry in orde supply its own files needed in great numbers in making saws.

Geographical distribution.—Of the 27 firms listed in the Hardw Manufacturer's Roster in 1918, 5 were in Pennsylvania; 3 each Massachusetts and New York; 2 each in Connecticut, Geor Indiana, Michigan, Ohio, and Tennessee; and 1 each in Illin Mississippi, Missouri, and New Jersey.

Of the 100 establishments as given by the census of 1914, 16 were Pennsylvania, 16 in New York, 11 in Michigan, 10 in Massachuse 9 in Illinois, and 8 in Ohio. The rest were in California, Connectic Georgia, Indiana, Maryland, Mississippi, Missouri, New Hampshi New Jersey, Tennessee, and Washington.

History.—As far as can be learned, the first saws of any kind ma factured in the United States were made by William Rowland, w started in business in Philadelphia in 1806, but the industry made lit headway in the first half of the century. Henry Disston, the foun of Henry Disston & Sons, began the manufacture of saws in a sm way in Philadelphia in 1840, and did much to promote the devel ment of the saw industry in the United States. The American s industry after it was once established grew rapidly and the Ameri product has not only practically displaced foreign saws in our o market, but is now sold in large quantities in foreign countries.

Domestic production and consumption.—The value of saws produ in the United States in 1914 was $12,517,000. Imports in the fis year 1914 were valued at only $63,570, or 0.5 per cent of domes production. Exports amounted to $1,474,000, or 11.8 per cent total production. From these figures it is evident that domes production considerably exceeded domestic consumption. Most the imports consisted of hand, back, and other saws not specia provided for, particularly jewelers' saws, of which none were made this country before the war. The source of supply of jewelers' sa was Germany. The absence of imports from Germany recent encouraged the manufacture of jewelers' saws in the United Stat and American manufacturers early in 1920 were offering jewele saws in quantity more than sufficient to supply domestic deman It was alleged by importers in May, 1920, that the American pri was below the German price, but that the American-made jewele saws were not equal in quality to the German product.

Domestic exports.—Exports in 1910 were valued at $919,48 They increased gradually until in 1913 they amounted to $1,605,94 In 1914 and 1915 they declined, amounting in the latter year only $972,167. During 1916 and 1917 exports increased sharply, reachi $4,611,098 in the latter year. In 1918 there was a slight decrea below the 1917 figure.

These exports went to all parts of the world. In the tables on page 157 are shown exports to countries to each of which exports in some one year 1910–1918 exceeded in value $50,000. There are 18 such countries, 8 in Europe, 2 in North America, 3 in South America, 2 in Asia, 2 in Australasia, and 1 in Africa. In 1910, the leading countries in order were Canada, England Australia New Zealand, France, and Germany, and again in 1913 in slightly different order. In 1918 the leading countries were England, France, Italy, Canada, Japan, and Australia. These figures show that American saws are successfully marketed both in the less developed and in highly developed industrial countries.

FOREIGN PRODUCTION.

Germany, England, France, and Sweden are leading foreign producers of saws. Before the war Germany had an extensive export trade, supplying, for example, about 40 per cent of the large Russian imports. *Germany* exported large quantities of saws also to Austria-Hungary, Belgium, France, Great Britain, Spain, Itlay and Sweden, as well as to South American and other countries. Nevertheless, Germany imported many saws from the United States, including crosscut, panel, back, compass, and hack saws. Her exports included veneer webs, pit saws, crosscut saws, compass saws, handsaws, backsaws, hack saws, and span webs.

France, like Germany, imported saws from the United States before the war, and had a considerable export trade to Russia, Spain, South America and to other countries. During the war her imports from the United States increased to many times the prewar figures. *Sweden* during the war became an important exporter of saws, her exports of saws, saw blades and saw webs in 1916 having been valued at 2,330,000 crowns, or approximately $625,000, as against imports of about $75,000. Before the war the manufacture of saws in Sweden was confined principally to two factories, Landviken jernverks Aktiebolog, at Landviken, and Stridsberg and Bjorck, at Trollhatten. They use a superior quality of steel and sell each saw with a guaranty. Of the saws imported before the war most of the specialties came from the United States and the ordinary saws from Germany. *England* manufactures saws extensively, but both before and during the war imported heavily from the United States.

IMPORTS.

Imports of saws have been small compared with production. In 1907 imports were valued at $37,744. They increased gradually until in 1910 they amounted to $57,661. In 1911 and 1912 imports declined but rose again during 1913 and 1914, amounting to $63,571 in 1914, the highest point in any year from 1907 to 1918. During the war imports decreased. In 1918 they amounted to only $24,846 and in 1919 to only $15,211. Countries of origin are not specified in our commerce reports, but an American manufacturer reports imports from Germany, England, and Sweden in the prewar period. Imports are classified as circular saws, crosscut saws, pit and drag saws, steel band saws, and hand, back, and other saws. Most of the imports have consisted of the last group—hand, back, and other saws. Detailed import statistics are shown on pp. 155–156.

During the six months ending December, 1919, the total value of saws imported was $42,364. Of this amount $41,551 represented "hand, back, and other saws not specially provided for." An examination of the records of the Customshouse of New York showed that imports of this group of saws through the port of New York for the same period were valued at $28,312, originating as follows: From Sweden, $12,917; from Switzerland, $7,035; from Germany, $4,770; and practically all the remainder from the Netherlands, France, Denmark, and England. Most of these saws were jewellers' saws, but invoices examined enumerated also dental saws, surgical saws, and handsaws.

PRICES.

Statistics showing comparative prices of saws in the United States and in foreign countries are not readily available. On page 158 of this survey, however, is shown some price statistics which indicate the trend of prices in this country since 1913. It may be observed that the wholesale price of Disston crosscut saws No. 2, 6-foot champion tooth, in 1913 was $1.782 per saw, and that this price was maintained until the end of 1915. Then the price rose gradually until it reached $3.60 in June, 1918, at which level it remained until the end of that year. This was an advance of 100 per cent. The wholesale price of Disston handsaws No. 8, 26-inch skewback, likewise remained stationary from 1913 to the end of 1915, at $15.609 per dozen. It then rose gradually until it reached $27.00 in June, 1918, at which level it remained until the end of 1918. This was an increase of 73 per cent.

TARIFF HISTORY.

The act of 1894 imposed a duty of 6 cents per linear foot on crosscut saws; 10 cents per linear foot on mill saws; 8 cents per linear foot on pit and drag saws, and an ad valorem duty of 25 per cent on circular, hand, back, and all other saws. The act of 1897 retained these duties on crosscut, mill, pit, drag, and circular saws and imposed a new duty of 10 cents per pound and 20 per cent ad valorem on steel handsaws, and raised the rate on hand, back, and all other saws to 30 per cent. The act of 1909 reduced the rate on crosscut saws to 5 cents per linear foot; that on mill saws to 8 cents per linear foot, and that on pit and drag saws to 6 cents per linear foot. It reduced the rate on circular saws to 20 per cent, on steel band saws to 5 cents per pound, and 20 per cent, and on hand, back, and all other saws to 25 per cent. The act of 1913 reduced the duties on saws further to a uniform ad valorem rate of 12 per cent.

Average imports during 1907–1909, under the act of 1897, were valued at approximately $41,000, and the average rate of duty was approximately 29 per cent. During the only three complete fiscal years under the act of 1909 (1911–1913) average annual imports were $46,000, and the average duty paid was approximately 24 per cent. With average duties cut down more than one-seventh, average annual imports increased only $5,000, or about one-eighth. If the year 1910, during which imports came in mainly under the act of 1909, is averaged in with 1911–1913, the average is increased to $49,000. In the fiscal year 1914, during nine months of which the act of 1913 was operating with its rate of 12 per cent, imports rose to

$63,570, an increase of more than one-third over the average of the three preceding years. After 1914, imports decreased and in 1918 amounted to only $24,846.

COMPETITIVE CONDITIONS.

The saw industry has been developed to a higher state of perfection in the United States than in any other country, largely because of our great domestic market, based on our lumber industry. The excellence of the American saw is generally recognized in foreign countries, and the market for it is world-wide. In Russia and some other countries, however, where a cheap saw is desired regardless of quality, the American saw did not compete successfully before the war. Before the war American saws were sold not only in Canada, Australia, and South America, and other countries not highly developed industrially, but also in England, France, and Germany. During the war our exports increased greatly, particularly to England, France, Italy, and Japan. It appears, therefore, that the American saw industry is well established in international competition, and American producers should have little difficulty in meeting competition at home and abroad. Any advantages which foreign producers may have in the way of lower wages is doubtless wholly or largely offset by the greater abundance and cheapness of raw materials and supplies in the United States, and the higher degree of organization of our larger producers. As a result of the cessation of imports of jewelers' saws from Germany, the manufacture of these small saws was established in the United States, apparently in 1919. According to a cost analysis made by E. C. Atkins & Co. in 1913 (Tariff Hearings, 1913), cost of material constituted 29.80 per cent of selling price of saws and factory supplies 5.74 per cent as against 32.88 per cent for shop labor.

In the Tariff Hearings, 1913, E. C. Atkins & Co. presented figures to show that English and Swedish saw manufacturers could sell their product at their regular prices, pay the duty and still compete with the United States manufacturers on a price basis. It should be noted, however, that imports were small despite these alleged conditions. Atkins & Co. at present assert that wages in Europe are at the rate of 33⅓ cents per hour for saw smiths as against our rate of 60 to 80 cents and that other trades are in proportion, and that foreign-made saws are offered at 20 per cent less than prices in the United States. They believe that relative costs in Europe and the United States have changed but little during the war.

Saws—Production in United States.

[From Federal Census.]

Year.	Value.	Year.	Value.
[illegible]	$6,444,000	1914	$12,517,000
1904	9,820,000	1918 [2]	25,000,000
1909	11,536,000		

[1] Other sources (from E. C. Atkins & Co.[2])

[2] Estimate based on statement of Atkins & Co. that prices have risen 80 per cent above 1914 level, and quantity produced has probably increased 20 per cent. Such percentages of increase added to the census figures for 1914 would give $27,000,000.

Saws, total—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad valorem rate
						Per cent.
1907	Specific and ad valorem.		$37,743.50	$11,124.89		
1908	do		40,667.75	12,070.57		
1909	do		45,128.05	12,565.41		
1910	do		57,660.93	14,260.60		
1911	do		55,156.63	13,400.59		
1912	do		37,040.42	8,720.76		
1913	do		45,961.00	10,711.68		
1914	do		63,570.30	8,929.72		
1915	12 per cent		47,504.00	5,700.48		
1916	do		26,135.00	3,136.20		
1917	do		27,782.00	3,333.84		
1918	do		24,846.00	2,981.52		
1918 [1]	do		18,473.00	2,216.76		
1919 [1]	do		51,645.00	6,197.40		

[1] Calendar year.

Saws, crosscut saws—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad valorem rate
		Linear feet.				Per cent.
1907	6 cents per linear foot.	7,429.25	$2,384.00	$445.76	$0.321	
1908	do	24,345.50	6,941.25	1,460.73	.285	
1909	do	26,810.50	8,207.30	1,608.63	.306	
1910	do	1,947.00	490.00	116.82	.252	
	5 cents per linear foot.	14,054.00	3,747.25	702.74	.267	
1911	do	15,464.60	4,458.75	773.26	.288	
1912	do	27,126.50	7,388.92	1,356.87	.272	
1913	do	18,443.00	5,080.00	922.15	.275	
1914	do	10,462.00	2,804.00	523.10	.268	
	12 per cent	11.00	17.00	2.04	1.55	
1915	do	15,346.00	4,421.00	530.52	.288	
1916	do	9,150.00	2,541.00	304.92	.277	
1917	do	142.00	142.00	17.04	1,000	
1918	do	28.00	27.00	3.24	.964	
1918 [1]	do	17.00	18.00	2.16	1,059	
1919 [1]	do	1,370.00	492.00	59.04	.359	

[1] Calendar year.

Saws, pit and drag saws—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad valorem rate
		Linear feet.				Per cent.
1907	8 cents per linear foot.	646.00	$205.00	$51.68	$0.317	
1908	do	1,718.00	354.00	137.44	.206	
1909	do	350.00	72.00	28.00	.206	
1910	6 cents per linear foot.	780.00	197.68	46.80	.253	
	8 cents per linear foot.	315.00	92.00	25.20	.292	
1911	6 cents per linear foot.	1,708.00	326.00	102.48	.191	
1912	do	3,051.00	606.00	183.06	.199	
1913	do	398.00	72.00	23.88	.181	
1914	do	42.00	25.00	2.52	.595	
1915	12 per cent	242.00	55.00	6.60	.227	
1916	do	83.00	23.00	2.76	.277	
1917	do	540.00	141.00	16.92	.261	
1918	do	466.00	139.00	16.68	.298	
1919 [1]	do	156.00	110.00	13.20	.705	

[1] Calendar year.

Saws, circular saws—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
.....	25 per cent.....	.....	$884.00	$221.00	.....	25
.....	.....do.....	.....	613.00	153.25	.....	25
.....	.....do.....	.....	3,069.00	767.25	.....	25
.....	.....do.....	.....	449.00	112.25	.....	25
.....	20 per cent.....	.....	5,262.00	1,052.40	.....	20
.....	.....do.....	.....	2,521.75	504.35	.....	20
.....	.....do.....	.....	2,947.00	589.40	.....	20
.....	.....do.....	.....	10,361.00	2,072.20	.....	20
.....	.....do.....	.....	2,097.00	419.40	.....	20
.....	12 per cent.....	.....	2,684.50	322.14	.....	12
.....	.....do.....	.....	3,033.00	363.96	.....	12
.....	.....do.....	.....	2,015.00	241.80	.....	12
.....	.....do.....	.....	1,972.00	236.64	.....	12
.....	.....do.....	.....	2,466.00	295.92	.....	12
.....	.....do.....	.....	1,213	145.56	.....	12
.....	.....do.....	.....	1,352	162.24	.....	12

lar years.

teel band saws, finished or further advanced than tempered and polished—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	10 cents per pound and 20 per cent.	2,959.00	$1,706.00	$637.10	$0.576	37.34
.....	.....do.....	7,462.00	2,549.00	1,256.00	.341	49.25
.....	.....do.....	601.00	325.00	125.10	.541	38.49
.....	.....do.....	93.00	85.00	26.30	.914	30.94
.....	5 cents per pound and 20 per cent.	2,429.60	1,546.00	430.68	.638	27.86
.....	.....do.....	2,261.33	1,102.00	333.47	.487	30.26
.....	.....do.....	2,151.00	805.00	268.55	.374	33.36
.....	.....do.....	2,606.00	977.00	325.70	.375	33.34
.....	12 per cent.....	1,685.00	169.00	20.28	.10	12.00
.....	5 cents per pound and 20 per cent.	835.00	326.00	106.95	.39	32.81
.....	12 per cent.....	736.00	398.00	47.76	.540	12.00
.....	.....do.....	119.00	176.00	21.12	1.478	12.00
.....	.....do.....	145.00	82.00	9.84	.565	12.00
.....	.....do.....	498.00	191	22.92	.383	12.00
.....	.....do.....	330.00	487	58.44	1,476	12.00

dar years.

and, back and other saws, not specially provided for—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
.....	30 per cent.....	.....	$32,564.50	$9,769.35	.....	30
.....	.....do.....	.....	30,210.50	9,063.15	.....	30
.....	.....do.....	.....	33,454.75	10,036.43	.....	30
.....	.....do.....	.....	5,988.00	1,796.40	.....	30
.....	25 per cent.....	.....	39,804.00	9,951.01	.....	25
.....	.....do.....	.....	46,748.13	11,687.03	.....	25
.....	.....do.....	.....	25,293.50	6,323.38	.....	25
.....	.....do.....	.....	29,471.00	7,367.75	.....	25
.....	.....do.....	.....	6,765.75	1,691.44	.....	25
.....	12 per cent.....	.....	48,682.05	5,841.85	.....	12
.....	.....do.....	.....	39,995.00	4,799.40	.....	12
.....	.....do.....	.....	21,158.00	2,538.96	.....	12
.....	.....do.....	.....	25,351.00	3,042.12	.....	12
.....	.....do.....	.....	22,132.00	2,655.84	.....	12
.....	.....do.....	.....	17,051.00	2,046.12	.....	12
.....	.....do.....	.....	49,204.00	5,904.48	.....	12

lar years.

Saws—Domestic exports.[1]

FISCAL YEARS.

Exported to—	1910	1911	1912	1913	1914	1
France	$35,129	$32,386	$68,982	$73,045	$81,206	
Germany	35,059	36,413	83,441	91,661	127,626	
Italy	1,443	4,558	7,899	6,411	7,183	
Norway	5,127	6,967	14,714	11,483	12,188	
Russia in Europe	14,733	13,435	20,030	20,968	55,278	
Spain	1,057	1,498	3,112	4,289	8,664	
England	154,793	162,764	182,145	206,861	210,358	1
Scotland	19,592	19,542	22,884	24,066	21,527	
Canada	203,262	283,785	267,810	346,887	234,721	1
Cuba	29,211	35,391	35,199	43,914	39,091	
Argentina	78,461	52,365	41,996	45,091	52,269	
Brazil	12,730	23,084	29,603	39,357	30,613	
Chile	17,813	38,128	60,573	44,838	33,435	
British India	8,145	13,106	4,855	13,233	13,422	
Japan	7,938	12,624	19,367	29,689	17,474	
Australia	132,341	178,697	278,596	258,695	234,125	1
New Zealand	36,530	41,103	75,116	87,212	57,526	
British South Africa	8,610	18,336	36,281	35,426	32,399	
All other	117,509	163,605	218,781	222,816	209,963	1
Total	919,483	1,137,787	1,471,384	1,605,940	1,474,077	1

Exported to—	1916	1917	1
France	$278,839	$1,010,160	$
Germany			
Italy	62,576	467,867	
Norway	43,481	75,473	
Russia in Europe	130,499	163,179	
Spain	25,277	82,151	
England	295,969	1,233,510	1,2
Scotland	39,968	69,215	
Canada	295,021	553,534	3
Cuba	48,310	78,751	1
Argentina	27,863	56,376	1
Brazil	27,148	65,479	
Chile	10,133	24,260	
British India	7,222	37,454	
Japan	41,263	115,463	2
Australia	114,100	132,582	1
New Zealand	51,776	45,368	
British South Africa	29,231	39,072	
All other	245,091	368,204	3
Total	1,773,767	4,611,098	4,5

CALENDAR YEARS.

Exported to—	1918	1919	Exported to—	1918	19
France	$524,073	$561,454	Brazil	$84,190	$2
Italy	481,125	172,905	Chile	47,923	
Norway	17,869	87,308	British India	49,066	
Russia in Europe	30,415	63,400	Japan	295,385	4
Spain	29,050	218,824	Australia	154,775	3
England	1,035,040	705,341	New Zealand	34,465	1
Scotland	39,702	65,260	British South Africa	63,826	1
Canada	258,127	220,750	All other	378,172	9
Cuba	132,638	116,775			
Argentina	134,575	206,503	Total	3,790,416	4,8

[1] Table includes all countries to which exports in any one year from 1910 to 1918 exceeded $50,000.

Saws; *crosscut, Disston, No. 2, 6-foot champion tooth, price per saw, wholesale, Philadelphia, Pa.*

[From War Industries Board. Price Bulletin No. 33. Prices of iron and steel and their products.]

	1913	1914	1915	1916	1917	1918
Year	$1.782	$1.782	$1.782	$2.011	$2.785	$3.375
Quarter:						
First				1.820	2.440	3.060
Second				1.943	2.680	3.240
Third				2.070	2.960	3.600
Fourth				2.210	3.060	3.600
Month:						
January				1.790	2.280	3.060
February				1.790	2.520	3.060
March				1.880	2.520	3.060
April				1.880	2.520	3.060
May				1.880	2.760	3.060
June				2.070	2.760	3.600
July				2.070	2.760	3.600
August				2.070	3.060	3.600
September				2.070	3.060	3.600
October				2.070	3.060	3.600
November				2.280	3.060	3.600
December				2.280	3.060	3.600

Saws, hand, Disston, No. 8, 26-inch skewback, per dozen, wholesale, Philadelphia, Pa.

[From War Industries Board. Price Bulletin No. 33. Prices of iron, steel, and their products.]

	1913	1914	1915	1916	1917	1918
Year	$15.609	$15.609	$15.609	$17.503	$22.008	$25.958
Quarter:						
First				15.860	19.800	24.500
Second				16.927	20.467	25.333
Third				18.020	23.267	27.000
Fourth				19.207	24.500	27.000
Month:						
January				15.600	19.800	24.500
February				15.600	19.800	24.500
March				16.380	19.800	24.500
April				16.380	19.800	24.500
May				16.380	20.800	24.500
June				18.020	20.800	27.000
July				18.020	20.800	27.000
August				18.020	24.500	27.000
September				18.020	24.500	27.000
October				18.020	24.500	27.000
November				19.800	24.500	27.000
December				19.800	24.500	27.000

Court and Treasury Decisions.

Saw blades classified as crosscut saws in paragraph 168 of the act of 1897 were held dutiable under the same paragraph as saws n. s. p. f. (Abstract 22767, T. D. 30382.)

Butchers' saws in coils were held dutiable under the provision in paragraph 168 of the act of 1897 for "other saws" and not as "band saws." (G. A. 4365, T. D. 20758.)

Hack-saw frames without blades are not dutiable under paragraph 139 of the act of 1913. (Abstract 32878, T. D. 33591, of 1913.)

Saws are dutiable at 12 per cent under paragraph 139 of the act of 1913, whereas the steel from which they are made is dutiable at 15 per cent ad valorem under paragraph 110.

Saws—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	172	Cross cutsaws	8 cents per linear foot.
1883	173	Mill, pit, and drag saws, not over 9 inches wide	10 cents per linear foot.
		Over 9 inches wide	15 cents per linear foot.
1883	174	Circular saws	30 per cent ad valorem.
1883	175	Hand, back, and all other saws, not specially enumerated or provided for in this act.	40 per cent ad valorem.
1890	183	Crosscut saws	8 cents per linear foot.
		Mill, pit, and drag saws, not over 9 inches wide	10 cents per linear foot.
		Over 9 inches wide	15 cents per linear foot.
		Circular saws	30 per cent ad valorem.
		Hand, back, and all other saws, not specially provided for in this act.	40 per cent ad valorem.
1894	154	Crosscut saws	6 cents per linear foot.
		Mill saws	10 cents per linear foot.
		Pit and drag saws	8 cents per linear foot.
		Circular saws	25 per cent ad valorem.
		Hand, back, and all other saws, not specially provided for in this act.	Do.
1897	168	Crosscut saws	6 cents per linear foot.
		Mill saws	10 cents per linear foot.
		Pit and drag saws	8 cents per linear foot.
		Circular saws	25 per cent ad valorem.
		Steel band saws, finished or further advanced than tempered and polished.	10 cents per pound and 20 per cent ad valorem.
		Hand, back, and all other saws, not specially provided for in this act.	30 per cent ad valorem.
1909	168	Crosscut saws	5 cents per linear foot.
		Mill saws	8 cents per linear foot.
		Pit and drag saws	6 cents per linear foot.
		Circular saws	20 per cent ad valorem.
		Steel band saws, finished or further advanced than tempered and polished.	5 cents per pound and 20 per cent ad valorem.
		Hand, back, and all other saws, not specially provided for in this section.	25 per cent ad valorem.
1913	139	Crosscut saws, mill saws, pit and drag saws, circular saws, steel band saws, finished or further advanced than tempered and polished, hand, back, and all other saws, not specially provided for in this section.	12 per cent ad valorem.

MISCELLANEOUS.

[From letter of E. C. Atkins & Co., Indianapolis, Ind., to Hon. Oscar Underwood, chairman Ways and Means Committee, Feb. 20, 1913.]

A few figures, which can be easily verified by reference to actual selling pricel, will show that under the present law English and Swedish manufacturers can sels goods in the United States at their regular prices, pay the duty, and still compete with United States manufacturers on a price basis.

Spear & Jackson, manufacturers of saws in Sheffield, England, will sell at prices that compare with our lowest prices as follows:

Size.	Spear & Jackson.	E. C. Atkins & Co.
Circular saws:		
10-inch	$1.10	$1.32
24-inch	3.21	5.40
48-inch	16.40	37.50
60-inch	41.31	60.00
Wide band saws:		
6-inch, per foot	.81	1.00
8-inch, do	.933	1.152

Swedish saw manufacturers offer the following comparative prices:

Size.	Swedish.	E. C. Atkins & Co.
Circular saws:		
24-inch	$2.79	$5.40
36-inch	7.02	12.40
60-inch	40.30	60.00
Crosscut saws:		
5-foot	.87	1.40
5½-foot	1.01	1.54
6-foot	1.17	1.68

The prices submitted are strictly on grades that are supposed to be the same general type in each case, and these foreign manufacturers' prices do not include duty. Saws of German manufacturers are even lower, and such goods hold the market in certain foreign countries.

A comparison in wages of operatives will show the reason for such wide variation in prices. Our experience, covering a period of 13 years, shows that the labor cost is by far the largest item going to make up the ultimate cost of the goods, as the table below will demonstrate.

To make up the gross selling price, the items average up as follows:

	Per cent.
Material	29.80
Shop labor	32.88
Factory supplies	5.74
Royalties	.41
Salesmen's expense and salary and selling cost	15.74
Office salaries and expense	2.80
General	1.65
Officers' and managers' salaries	1.42
Bad accounts	.40
Gross profits	9.16
Selling price	100.00

Out of gross profits are to be charged off depreciations of plant, patents, patterns, stocks on hand, leaving the balance to apply to betterments, dividends.

This showing indicates that in one way or another the item of wages, salary or pay of employees constitutes a very large percentage of the cost entering into consumption. The selling cost is mainly made up of wages and salaries paid to salesmen, branch house employees, advertising department employees, and a small portion only covers items of expense outside of salaries.

We want to submit, for your consideration, a comparison of wages here and abroad as a reason why we would only compete at a loss on an even basis unless we reduce our pay to their basis.

		France.	Germany.	United States.
Saw smith	per hour		$0.20	$0.10–$0.12	$0.40–$0.50
Saw filers	do	$0.16– .18	.10– .12	.25– .30
Saw toother	do	.14– .15		.20– .30
Machine hand	do	.18	.15	.30– .30
Common labor	do	.10	.07½	.17½– .20

The example from Germany is the factory of Goldenberg & Co. at Zomhof Zebern. The French wages are the general average of wages in such pursuits.

O

UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 106 AND 107 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

Paragraph 106:
- Anchors
- Forgings
- Antifriction Balls and Bearings

Paragraph 107:
- Hoop, Band, and Scroll Iron (See Par. 105)

REVISED EDITION

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UNITED STATES TARIFF COMMISSION.

Office: Eighth and E Streets NW., Washington, D. C.

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.

2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.

3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and index" the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of P. M. Tyler and Walter Graham, of the Metals Division of the Commission's staff, and of others.

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ANCHORS.

SUMMARY.

e anchor industry may be roughly divided into two sections—one facturing the light anchors for mooring small boats and the engaged in the manufacture of anchors for large vessels. In al it may be said that foreign competition in the American et is not a great factor and after the outbreak of the war it was gible, although the imports since the armistice have increased ly. England is the largest producing nation, and in that country are several large firms which specialize on the manufacture of ors and chain cable (anchor chain) as their chief products, eas, in this country, anchor making is a minor branch of the done in the factories in which they are made. Of the comtively few anchors that are imported, a decreasing percentage mported duty paid, recent imports especially being entered ly under the provision for the free entry of material for the r, equipment, or construction of vessels.

nerican manufacturers of small-boat anchors seem to have some ntage as compared with manufacturers in other countries and tain amount of these anchors are exported to various foreign ets, competing on favorable terms with those made in other tries. In the case of large ships' anchors the competitive status e American industry is less favorable, although the importation se bulky articles is restricted by the cost of transportation from nd to American shipyards.

Iron and steel anchors, or parts of—Summary table.

Fiscal year.	Imports for consumption.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual or computed equivalent ad valorem rate.[1]
	Pounds.				*Per cent.*
.....	78,435	$2,855	$784.35	$0.036	27.47
.....	82,648	2,071	826.48	.025	39.91
.....	81,042	3,237	476.68	.04	14.73
.....	96,033	3,941	940.28	.041	23.86
.....	127,548	4,241	527.00	.033	12.43
.....	13,704	337	40.44	.025	12.00
.....	41,366	1,454	174.48	.035	12.00
.....	110,062	5,285	313.32	.048	12.00
.....	704,274	42,712	225.36	.060	12.00
.....	644,855	41,997	193.92	.069	12.00
.....	565,272	60,720	865.92	.108	12.00

[1] Duty-paid imports. [2] Calendar year.

GENERAL INFORMATION.

ACT OF 1913.

ragraph 106. Iron or steel anchors or parts thereof * * * 12 entum ad valorem.

DESCRIPTION.

An anchor is a device for securing a vessel to the ground under water by means of a cable. Anchors are made of iron and steel, forged or cast or cast with forged parts, the smaller boat anchors being forged entire or cast from molten metal and the larger ship anchors being generally of cast steel fitted with rings, pins, shackles, shanks, and balancing bands, all of which are forged parts. A typical anchor consists of a strong shank, at one extremity of which is a "crown" from which branch out two arms which curve inward, each arm terminating in a broad palm or fluke, the tip of which is known as the peak or bill. At the other end of the shank is a stock, a transverse piece to which is attached a shackle or ring for the cable. The principal use of a stock, which in nearly all anchors is made of iron and is placed at right angles to the curved arms, is to cause the arms to fall so that one of the flukes will enter the ground.

Anchors are classed according to their uses into starboard bower, port bower, sheet, spare, stream, kedge, folding, and grapnel or boat anchors. The United States Navy uses stocked cast steel, stockless, and boat anchors. In addition to the above there are various special anchors such as hollow shank (for lightness), Porter's (with movable arms pivoted to the shank), and the Trotman, an improvement of the Porter. The Martin is a self-canting anchor, the arms revolving through an arc of 30° either way, so that the point of the fluke may more readily enter the ground. The Tyzack anchor has only one arm which is pivoted on a bifurcation of the shank and arranged so as to swing between the two parts. A mushroom anchor has a cast-iron bowl-shaped head fastened to a forged shank and is used for mooring small boats. Mooring anchors are used almost exclusively by the Lighthouse Service. Boat anchors generally weigh from 30 to 120 pounds each and are ordinarily galvanized. The anchors for large ships weigh up to 5 tons.

Among the minor parts of anchors may be mentioned *nuts*, which are two projections welded on the shank for securing the stock shoes, which are triangular pieces of plank used in giving a better hold on soft bottom.

DOMESTIC PRODUCTION.

Statistics of domestic production are lacking. It is not a large business and its importance varies with the state of the shipbuilding industry in this country.

Materials.—A few anchors for motor boats may be made of brass or bronze, but the larger anchors are made of forged or cast steel, or straight carbon steel, or wrought iron. For stockless anchors acid or basic open-hearth steel castings are employed for all parts except the shackles, which are forged. For boat anchors a high-grade refined iron is used; these are also frequently galvanized. Small-boat anchors, mushroom anchors, and mooring anchors are frequently manufactured from cast iron, pig iron, and scrap, together with coke and other foundry supplies. All these supplies and materials can be obtained as readily and cheaply in this country as abroad, although refined iron may again prove cheaper at English anchor works.

Equipment.—The equipment required in the manufacture of anchors will vary with the type of anchor and the character of the raw ma-

rial. In general no special equipment is required in making cast-teel anchors other than that commonly found in plants making other ypes of steel castings.[1] Cast-iron anchors can be made in an ordi-ary foundry.[2] Heavy forged parts are produced in the United States y means of powerful hammers and presses, although abroad these are requently made by hand. The smaller forged parts are made by auto-natic drop hammers.[3] The larger sizes of anchors must be tested by ome type of testing machine. These may be in the shop or in an out-ide testing plant, located at or near the shipbuilding plant. An in-spector of Lloyds Register must be present at these tests in order to permit their certification for use on insured vessels.

Method of production.—The manufacture of anchors and parts—whether cast or forged—presents no special problems. The labor employed on such work in this country is relatively unskilled, many of the major operations being performed by semiautomatic machinery. The making of large forged anchors, formerly a formidable piece of smithwork, is now relatively simple, owing to the general use of a steam hammer. The shanks of these large anchors are built by welding together bars of iron. The assembling is not a difficult operation and practically no finishing is required.

Organization.—About half of the anchors produced in the United States are made in plants which are devoted largely to producing other articles, especially steel castings and forgings. Cast-iron anchors also are made in various iron foundries. A few firms purchase castings and forge the shackles and other parts and assemble. Anchors of small size are ordinarily made in small plants, and in sizes up to about 300 pounds are generally sold through jobbers, although a few are sold direct. A wide market is desirable and a large fraction of the domestic output comes from large plants which, however, do not specialize on the manufacture of anchors. A highly developed organization is not required, since the market is not sufficiently extensive.

Geographical distribution.—According to Thomas's Register of Manufacturers there are 7 factories in New England, 9 in New York State, and 9 in Pennsylvania, and 1 each in Ohio, Illinois, and California. The bulk of the production comes from the Eastern States, from plants located in the vicinity of shipbuilding plants and ports.

History of the industry.—The manufacture of anchors is an ancient industry, closely allied to the shipbuilding trade. In general, it may be said that the manufacture of anchors developed earlier and has progressed further in England than in the United States. On account of the extraordinary expansion in domestic shipbuilding since the outbreak of the war, the manufacture of anchors in the United States has also been greatly stimulated, particularly since supplies from abroad were not available.

Domestic production and consumption.—Domestic requirements, even during the war-time expansion in shipbuilding, have been amply supplied by American plants. Statistics of production are lacking, but since the imports are practically negligible, it would seem that this country is self-sufficing. Illustrating the expansion of the business during the war period, one firm reports to the Tariff Commission that its production of stockless anchors in 1914 amounted to 300,000 pounds as compared with 1,470,000 pounds in 1919. Another plant reports a slight increase in production (less than 10 per cent) in 1919

[1] See Steel Castings survey. [2] See Iron Castings survey. [3] See Forgings survey.

as compared with the previous year (1918), although the value of the output, due to lower prices, was materially less in 1919. Production during 1920 was at a greatly reduced rate, figures for the first six months, as supplied by certain manufacturers, indicating a quantity of only about one-fourth the 1918 total and a value of less than one-seventh.

Domestic exports.—There are no statistics of exports of anchors from the United States. According to replies to the commission's questionnaire certain firms export anchors—especially small sizes. One firm reports that it has no difficulty in meeting foreign prices in Latin American countries, the Far East, and even in Europe. Larger anchors (stockless) are also sold in some quantity to China, Italy, France, Argentina, and Canada.

FOREIGN PRODUCTION.

England is the principal anchor manufacturing country and British anchors are shipped to all parts of the world. The industry is closely allied to the manufacture of ships' cable and chain, and is localized at Netherton and Tipton in the Cradley Heath district. The combined exports of chains, cables, and anchors from the United Kingdom amounted in 1913 to 34,533 tons and in 1918 to 21,764 tons. A considerable amount of equipment is used in British works and it is said that Nasmith installed his first steam hammer in the anchor works there. British wages have advanced greatly since 1913. Anchor makers are paid on piece work and in 1920 were earning as much as £10 a week ($48.65 at normal exchange). The British advantage seems to be confined to the production of large wrought-iron anchors, a certain amount of light anchors for small boats being imported from the United States.

IMPORTS.

Only small imports of anchors are recorded prior to the war, the 1913 imports amounting to 96,033 pounds, valued at $3,941. There was a slight increase in the fiscal year 1914, but in 1915 and 1916 the imports were absolutely negligible. In 1917 and 1918 (fiscal years) they again increased to more than the average prewar quantity, and in the last half of 1918, owing to the great expansion in American shipbuilding, the quantity and value of the anchors imported exceeded all previous records. In the calendar year 1919, 565,272 pounds of anchors, valued at $60,720, were imported. All but about 15 per cent of the anchors imported in that year were imported for use in the construction, repair, or equipment of vessels and were therefore free of duty.

Prior to the war, anchors were imported in small quantities from Germany and England, both of these countries introducing a certain amount of competition in the American market. During and since the war, the only imports have been from England, and as a rule the prices charged have been equal to or above those charged by American manufacturers.

PRICES.

The prices of anchors are not quoted in trade journals, and on account of the great variety of types it is impossible to present full price statistics. On the large anchors a steady advance in prices is reported. Prior to the war the average may be taken at between

4 cents and 6 cents per pound, increasing during the war period to between 12 cents and 20 cents. Since the war prices have declined to between 10 cents and 12 cents per pound. Increases in the case of stockless anchors have been somewhat less, the average during the years 1898 to 1917 being approximately 4.5 cents per pound, which was advanced in 1918 and 1919 to 9.125 cents to 9.5 cents, declining to 7.5 cents in 1920. Mooring anchors (cast iron) ranged from 3.6 cents to 5.3 cents per pound before the war, and have increased quite steadily to a maximum of about 10 cents per pound in 1920. The invoice prices of the anchors imported into the United States show a rapid increase, the average in 1919 being 10.8 cents per pound.

TARIFF HISTORY.

Specific duties were imposed on anchors in the acts from 1883 to 1913. Under the act of 1883 the duty was 2 cents per pound, which was reduced to 1.8 cents in 1890 and to 1.2 cents in 1894. In 1897 it advanced slightly to 1.5 cents, but was again reduced in 1909 to 1 cent per pound. The ad valorem duty of 12 per cent under the act of 1913 was equivalent to a further reduction at then prevailing prices, the imports in that period having an average value of between 3 and 4 cents per pound, although on certain types of anchors the 1913 protection amounted to over 2 cents per pound. The specific duty under the 1909 act was equivalent to approximately 30 per cent. Anchors may also be imported free of duty under the provision for articles for the equipment of vessels, and as stated above the imports under this provision have increased markedly since the cessation of hostilities.

In foreign countries anchors are ordinarily admitted free of duty or at relatively low rates.

COMPETITIVE CONDITIONS.

While a certain amount of foreign competition was felt by domestic manufacturers prior to the outbreak of the war, it has not been felt in the domestic market in recent years. One manufacturer reports that he experienced active competition from England and Germany before the war and claims that he lost about 20 per cent of his trade, owing to the free admission of anchors for equipment of vessels which permitted the foreign anchors to be sold here at lower prices. At the present time a small export trade has been developed and domestic manufacturers apparently have some advantage in foreign markets as compared with the English makers of small anchors, while in the larger sizes the British manufacturers apparently have the advantage.

Domestic manufacturers are at no disadvantage as compared with their foreign competitors in securing raw material, although the British anchor makers, in view of their favorable location, can get local Staffordshire wrought iron cheaper than the average domestic anchor maker. Fuel costs are greater in England. American equipment is fully the equal of that used in England and the cost of installation is not a factor in the competitive situation. Certain varieties of anchors were at one time protected by patents, but these have all expired. Specifications adopted by Lloyd's Register have done much to standardize the product and

have, therefore, proved beneficial to domestic producers. Wa
the United States have increased from approximately $3 pe
(prewar) to $7.20. These figures roughly represent the incre
labor cost in the manufacture of both cast and forged anchor
parts. British wages are somewhat lower, particularly in vi
the exchange situation, and the labor cost is also considerabl
especially in the manufacture of heavy forged anchors. (
freight rates, however, are an important factor and probabl
largely offset any British advantages in cost of production.
high quality of British anchors is however a factor and the p
exchange situation has also favored increased imports. Alt
these may be largely attributed to the expansion in domestic
building.

TARIFF CONSIDERATIONS.

Replying to the Tariff Commission's questionnaire a manufa
in Cleveland, Ohio,[4] states that the industry requires no tarif
tection other than a compensatory duty to cover duties o
materials. He further states that paragraph 106 of the tari
of 1913 does not affect anchors, since they are virtually free of
for use in the repair, construction, or equipment of vessels.
1910 to 1917, inclusive, only 8.63 per cent of the total imports
in free of duty under these provisions, but, in 1919, 85 per c
the total were entered without payment of duties. On accou
the considerable number of varieties of anchors, it would seem
ad valorem rates are preferable to specific.

Anchors or parts of—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Act com ad
		Pounds.				*P*
1907	1½ cents per pound.	64,431	$2,308	$966.47	$0.036	
1908	....do....	125,825	3,739	1,887.38	.03	
1909	....do....	46,213	1,665	693.20	.036	
1910[a]	1 cent per pound.	78,135	2,855	784.35	.036	
1911	....do....	82,648	2,071	826.48	.025	
1912	....do....	47,698	1,494	476.68	.031	
1912	Duty remitted, section 19.	33,371	1,743	.....	.052	....
1913	1 cent per pound.	94,027	3,795	940.28	.04	
1913	Duty remitted, section 19.	1,500	91	.....	.061	....
1913	Duty remitted, Panama act.	500	55	.....	.109	....
1914[b]	1 cent per pound.	13,124	350	131.24	.027	
1914[c]	12 per cent.	97,494	2,298	395.76	.034	
1914[d]	Free, section 4, J. 5.	16,630	593	.....	.035	....
1915	12 per cent.	13,704	337	40.44	.025	
1916	....do....	41,566	1,454	174.48	.035	
1917	....do....	48,133	2,611	313.32	.054	
1917[d]	Free, section 4, J. 5.	61,929	2,674	.....	.043	....
1918	12 per cent.	37,357	1,878	225.36	.05	
1918[d]	Free, section 4, J. 5.	699,797	40,811	.....	.061	....

[a] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[b] Old law, July 1, 1913, to Oct. 3, 1913, under act of 1909.
[c] New law, Oct. 4, 1913, to June 30, 1914, under act of 1913.
[d] For construction and equipment of vessels.
[4] See files of United States Tariff Commission.

Anchors or parts on—Imports for consumption—Revenue—Continued.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Pounds.*				*Per cent.*
1918 [1]	Free, section 4, J. 6	120	$20.00		$0.167	
1919	12 per cent	92,999	7,457.00	$894.84	.08	12.00
Calendar years:						
1918	do	37,344	1,616.00	193.92	.043	12.00
1918 [2]	Free, section 4, K.	105,971	4,425.00		.042	
1918 [3]	Free, section 4, J. 5.	501,420	35,936.00		.072	
1918 [1]	Free, section 4, J. 6.	120	20.00		.167	
1919	12 per cent	84,483	7,216.00	865.92	.085	12.00
1919 [2]	Free, section 4, K.	24,340	2,072.00		.085	
1919 [3]	Free, section 4, J. 5.	456,449	51,432.00		.113	

[1] For the repair of vessels.
[2] For supplies of vessels.
[3] For the construction and equipment of vessels.

Ball shank mooring cast iron anchors—Prices (wholesale).

[From replies to questionnaire, auxiliary file, p. 3.]

Date.	Pounds.	Price per pound.	Date.	Pounds.	Price per pound.
		Cents.			*Cents.*
Jan. 1, 1911	50-1,250	5.3 -4.2	Jan. 1, 1916	50-1,250	5.76-4.47
1912	50-1,250	4.2 -3.36	1917	50-1,250	6.4 -4.75
1913	50-1,250	4.5 -3.6	1918	50-1,250	8.0 -6.2
1914	50-1,250	4.5 -3.6	1919	50-1,250	8.9 -6.76
1915	50-1,250	4.5 -3.6	1920	50-1,250	10.71-8.11

Iron or steel anchors, or parts thereof—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	163	* * * anchors or parts thereof, * * * weighing each 25 pounds or more.	2 cents per pound.
1890	153	Anchors, or parts thereof, of iron or steel, * * * weighing each 25 pounds or more.	1 1/5 cents per pound.
1894	126	Anchors, or parts thereof, of iron or steel * * *	1 1/5 cents per pound.
1897	127	Iron or steel anchors or parts thereof	1½ cents per pound.
1909	123	do	1 cent per pound.
1913	106	do	12 per cent ad valorem.

Iron or steel anchors—Foreign rates of duty.[1]

	British preferential tariff.	Intermediate tariff.	General tariff.
Canada:		*Per cent.*	
455. Anchors for vessels	Free	7½	7½ per cent.
Australia:			
190. Anchors, over 10 hundredweight	Produce or manufacture of United Kingdom. Free.		General tariff, 10 per cent.
Belgium:			
43. * * * anchors * * *	Free		
France:			
560. Anchors, chains and cables per 100 kilos. G.	General tariff, 0.25 francs.		Minimum tariff, 0.25 franc.
Japan:			
480. Iron anchors, per 100 kin	General tariff, yen, 1.95.		Conventional yen—

[1] Kelly's customs tariffs.

FORGINGS.

SUMMARY.

orgings are the products of hammers, presses, and for
hines and may be either hand or machine made products of
steel, and may be classed mainly as finished articles. Ur
igraph 106 of the tariff act of 1913 forgings are dutiable at 12
ad valorem, while under paragraph 110 special steel ingots, fi
:h forgings are made, are dutiable at 15 per cent ad valor
er paragraphs specifically provide for certain forged commodi
ates which are inconsistent with paragraph 106.
he domestic production of forgings in 1918 was 1,295,566 g
. Much of the product is of special design and made from hi
le material. The industry is manifestly a very important
is concentrated especially in the great manufacturing district
England, New York, Pennsylvania, and along the Lakes
:ago and Detroit.
1 view of the relatively small importations of miscellane
ings into the United States, it is evident that in recent y
ign competition in these articles has not been an important fa
he American market. Forgings made by a distinctly mechan
:ess can generally be produced much more cheaply at home t
)ad, and the large home consumption has fostered the growt
e and efficient factories. Raw materials can be obtained f
heaply in the United States as in other countries. In gener
be said that European wages now (1920) are nominally at
tly lower levels than American in this industry, although actu
:h lower because of the depreciated currency in those count
would seem that the chief competition which the Ameri
ing industry must face is in superior qualities of steel casti
luced chiefly in American plants. When imported, steel cast
dutiable at 8 per cent for ordinary steel and 15 per cent for spe
l, under the tariff act of 1913.

Forgings of iron and steel—Summary table.

scal year.	Calendar year,[1] domestic production.	Imports for consumption.	Domestic exports.	Value of imports for consumption.	Amount of duty.	Value per unit of quantity.	A eq le va r
	Gross tons.	*Pounds.*					*Pe*
	319,862			$281,981.83	$84,560.95		
	218,236			137,159.00	41,147.70		
	302,528			134,037.00	40,211.10		
	407,983			182,626.90	54,703.77		
	341,421			150,339.00	23,387.94		
	523,723			44,621.00	4,812.24		
	923,767			40,310.00	4,831.80		
	1,078,765			37,302.00	4,476.24		
	1,295,566		$37,476,709	[2]1,649,068.00	27,891.60		
		3,829,700		236,547.00	28,385.64	$0.062	

cludes only the output from rolling mills and steel works, chiefly heavier products, including
407,905 imported "for the use of the U. S." duty free.

General Information.

TARIFF ACT OF 1913.

PAR. 106. * * * forgings of iron or steel, or of combined iron and steel, but not machined, tooled, or otherwise advanced in condition by any process or operation subsequent to the forging process, not specially provided for in this section, 12 per cent ad valorem.

DESCRIPTION.

Forging is described as a method of working metal with a hammer or press,[1] but the term is ordinarily confined to the operation of changing the shape of the metal, usually while hot, but not melted, by means of blows or pressure and distinguishing from stamping and pressing sheet metal, as well as from cutting, rolling, spinning, or casting. Wire manufactures are not included under this designation.

Forgings of iron and steel.—The articles are forgings of iron or steel, or forged iron, but they have been subjected to various further processes of manufacture, additional to that of forging, such as filing, grinding, polishing, drilling, riveting, etc.[2].

Drop forgings are made by forging the material between dies; one die is attached to the anvil block, the other to the hammer or moving part of a press. For certain complicated articles and where the amount of deformation is considerable, two or more sets of dies are required. While these dies must be of special design and are therefore expensive in initial cost, drop forging is more of a machine operation suited to the relatively cheap production of standard products in large quantities.

Hollow forgings are pipes and shafts forged about a mandrel which can later be removed. *Hydraulic* forgings are made in hydraulic presses by a steady pressure instead of hammering, armor plate, guns, and many projectiles are examples of this class.

Certain forgings are specifically mentioned in the tariff act of 1913, as for example, axles (par. 121); chains (par. 126), and anchors (par. 106), in addition to various more highly finished products which have received subsequent machining, etc. Such forgings are treated in separate surveys on the different products and are, therefore, not included in this discussion. There is some conflict between forgings as described in this paragraph and "hammer molds or swaged steel" which is mentioned in paragraph 110. It is possible that the latter designation was intended to cover drop-forgings, but the language is not sufficiently clear or specific.

Steel balls not further advanced than the forging process, used for crushing cement or ores, are dutiable under paragraph 106 as forgings and not as ball bearings.[3]

USES.

It is practically impossible to list the various uses of forgings. It may be said generally that forgings will be used instead of castings and even rolled products whenever greater strength and particularly resistance to shock is required. Forging improves the quality of the

[1] Tiemann, Iron and Steel.
[2] Treasury Decision 10657 (G. A. 241).
[3] Abstract 38032. Decisions.

metal, making it stronger and more homogeneous. On account of th expense of the process, only the better grades of steel and iron ar now commonly forged although, up to about 100 years ago, practicall all iron and steel used in the United States was worked under th hammer. Rolling on a large scale and the manufacture of stee castings are more recent developments and both these processe may be considered as producing substitutes and competing article for forgings. Forging has the advantage as compared with many castings and machined products that only a comparatively small amount of metal is lost as scrap.

"Possibly the greatest advance made in late years in forging is the application of machine methods to the production of engine and machine parts. It is now possible to forge many parts from steel and wrought iron, which a few years ago could only be made from castings. This means a great saving of time and expense, as not only are machine forged parts much more rapidly made than those made from cast iron or steel castings, but they also cost considerably less to manufacture in large quantities."[4]

The automobile industry is a large consumer of forgings which are used for axles, crank shafts, gear blanks, and other parts. Mining machinery and other classes of machinery subjected to rough usage require an unusual amount of forged parts. The railroads are also large consumers, especially of heavy forgings. Practically all the machinery industries use a certain amount of forgings and these articles are extensively employed in various munitions, including armament, guns, and projectiles.

Crucible steel ingots are often forged instead of rolled, because the material will bring a price high enough to pay for the superior method of working it. The bar is very straight and true.[5]

Chrome-nickel steels are difficult to forge, as it is dangerous to hammer them after the temperature has dropped below that which makes the metal a bright yellow. It must be heated repeatedly to forge pieces of any size and intricate shape.[6]

Tool steel, low or high carbon, regular, special or alloy crucible and open-hearth steels are made for automobile parts, lathe spindles, piston rods, pinion blanks, straight shafts, collared shafts, crank pins, feed screws, jack screws, hydraulic press rams, rock drill pistons, die blocks, die blanks for tube drawing, shear knife blanks, well bit and jar steel, grading and finishing rolls, trunnion balls, etc.[7]

Electric high carbon tool steel and high speed steel are used fo die blocks.

DOMESTIC PRODUCTION.

There are no statistics showing the entire domestic output o forgings. The Federal census groups forgings with rolled products The figures of the American Iron and Steel Institute are only fo forgings produced in rolling mills and steel works. In 1918, th production in such works was 1,295,566 tons but there are larg numbers of forging plants outside of steel works. While it is possibl that the tonnage made in these smaller plants is less than that pro duced in the larger works, it consists largely of the smaller, more intri

[4] Machinery's Reference Book, No. 114, p. 3.
[5] The Metallurgy of Iron and Steel, Stoughton, 1913.
[6] Steel and its Heat Treatment, Houghton & Co., p. 23.
[7] Catalogue D, Carpenter Steel Co., p. 138.

forgings usually made from special steels and requiring skillful treatment. The industry is manifestly a very important one.

Materials.—The materials are wrought iron, forging carbon steel, alloy steels, in the form of ingots, blooms, billets or bars. Forging is open-hearth or electric steel of better quality than ordinary and sells at a higher price. The chief sources of supply are the steel works of Pennsylvania, Ohio, Indiana, and Illinois.[8] The supply is adequate and the domestic manufacturer is at no disadvantage in procuring supplies of materials.

Equipment.—The equipment consists of hammers (hand, steam, or drop), hydraulic forging presses (up to 14,000 tons pressure capacity) or upsetting and forging machines, and heating furnaces, and annealing and heat treating equipment. Chemical and physical laboratories for chemical and physical tests constitute an important part of the plant. Metallographical study of the structure of forgings with the microscope in the laboratory is essential to the production of high grade forgings. Dies for drop forgings may be made from electric high carbon tool steel, alloy electric steel, nickel, nickel-chrome, high carbon chrome, and silico-manganese-chrome steel.[9] These expensive products may be produced in the plant in which they are used or purchased as part of the equipment.

Equipment is of domestic manufacture and design and domestic manufacturers have the comparative advantage over foreign manufacturers in procuring it.

Methods of production.—Forging, generally speaking, is work of skilled male labor and expert metallurgists. Abroad hand labor is used more than in the United States, the standardization of duplicate parts by machinery being an American practice.

Hammering, rolling and pressing compared: Rolling is the cheapest method, especially for labor. It does not work the metal as well as either hammering or pressing, both of which produce a much better crystalline structure, besides affording a better control of the temperature at which the operation is ended. Pressing works the metal to greater depths than hammering, and is therefore especially advantageous for producing large pieces. The press is also used on special forging work such as drawing, special punching and closed die forging.

Drop forging: There is a large variety of articles, such as parts of machinery, hammer heads and similar tools, which are formed by a process known as drop forging. In this operation a piece of metal is forged by repeated blows between a lower die, upon which it rests, and an upper die attached to the head of the hammer. These two dies are made in the desired form of the finished article, and the metal is squeezed into them until it has assumed the proper shape. Sometimes several pairs of dies are necessary to complete the finished shape. Drop forgings are directly comparable with steel castings, which they are superior in quality on account of the beneficial effect of the working. To be economically made they must be ordered in large quantities, so that it will pay to make the costly dies of hardened steel—often an alloy. Even then castings are sometimes cheaper, although forgings are preferred on account of their quality. There are cases, however, in which drop forgings may be made more economically.

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[8] See surveys of Ingots, blooms and billets and bars and Alloy steels, for conditions of supply.
[9] Peter A. Frasse & Co., Catalogue, pp. 13 and 25 to 24.

Pressing: Steel may be pressed either hot or cold. The latter method is used chiefly for thin and soft steel and the former for very large work, such as armor plate, cannon, etc. Presses vary from 600 to 14,000 tons pressure capacity. Effect of pressing: Its action extends deeper into the metal than hammering, giving a superior texture in the interior. The amount of work done is greater, saving fuel. Cold pressing and flanging: Thin plate is formed by pressing it between dies. Car bolsters, braces, etc., are formed cheaply.[10] The forming of automobile bodies and guards, etc., has become an important industry.

Cold hammering is a form of cold working by straining the cold metal slightly beyond its elastic limit. It may consist of slightly reducing cross-section area, distorting by bending or twisting, punching, shearing; after cold working, annealing restores softness and ductility reduced by cold working.

Forging cannon: Large cannon tubes are made from ingots weighing perhaps 65 tons or so, the upper half of which is discarded. In France and Germany cannon tubes have been made of crucible steel by pouring many crucibles into one mold, but the expense and liability to heterogeneity because of the many small units is believed to outweigh the advantages due to the quality of the crucible steel.

The forging press of the United States Navy at Charleston, W. Va. is 14,000 tons capacity. The steel maker is put under the severest call on his skill as a metallurgist in the manufacture of heavy ingots for forging into the costly inner tubes for large guns. Such ingots exceed 100 tons weight.[11]

Heating: Poor heating spoils steel and prevents satisfactory results from heat treatment. With heats too high, while the surface is hot, dripping, the center is hard; slow, soft, soaking heats are desirable, the fire should be deoxidizing. The alloy steels do not require high, sharp, dripping heats and require slow soft, nonoxidizing heats.[12] Alloy steels, including high-speed steels, require slower heating and cooling than carbon steels.[13]

Annealing: Carbon tool steel that has been well worked under the hammer is generally too hard to be readily machined without being annealed (heated to about 1,400° F. and cooled slowly in a closed box, pipe, or muffle to prevent contact with air for several days).

Hardening: After annealing the forging is slowly heated to about 1,500° F. (if hardening is required for its particular use) and allowed to cool in dry lime, reheated to 1,500° F. and chilled in water at 65° F. or in oil at 70° to 80°.

Tempering: All tools for cutting and punching should be tempered. The steel is slowly heated to straw to blue color for 15 minutes and immersed in oil.[14]

Testing: "While the practice of testing steel by investigating the chemical and physical properties has been followed in American forge shops for many years, the problem of adapting laboratory routine to the complex requirements of mass production was not satisfactorily solved until the rapid development of the automotive industry within the past few years directed the attention of experts to the subject."[15]

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[10] The Metallurgy of Iron and Steel, Stoughton, 1913.
[11] The Iron Age, Feb. 6, 1919, p. 401.
[12] Bullens.
[13] Midvale S. & O. Co. Alloy and Tool Steel, 1920.
[14] Ludlum Steel Co., Catalogue, p. 131.
[15] New England forge plant owes success to laboratory, the Iron Trade Review, July 8, 1926, pp. 97-100.

Organization.—The efficient conduct of the more important anches of the industry requires highly developed organizations mbining technical experts and skilled and common labor. The ge steel works cover this in their regular organization, but the ecial forging plants build up such an organization for the forging siness alone. Because of the varied specifications for design of e product, material, and treatment, a large number of forging plants ve been established outside of the steel works. The output of dividual establishments varies from that of the country blacksmith the heavy tonnages made in the axle plants of steel works and the ghly valued production of special forging plants producing com- onent parts for the automotive industry. For these latter a large arket is necessary, which exists in America. Drop forging between es is a highly standardized process, producing large quantities of dentically the same product.

The old charcoal forges and bloomeries are passing away, the umber of establishments having declined from 93 in 1880 to 6 in 905.

Census figures are incomplete and generally include rolled and rged products together.

Geographical distribution.—The industry is most largely estab- shed in the great manufacturing districts of New England, New ork, Pennsylvania, and along the Lakes to Chicago and Detroit, here the automobile industry is largely located, this forming a large art of the market for special forgings.

History of the industry.—The history of forging iron and steel robably begins with the discovery of iron and steel. The early omestic ironworks were called "forges;" they were plants to manufacture iron direct from the ore. A hammer was part of the lant and was used to forge the rough lump of wrought iron mingled with slag, called a "loop" or "bloom," into a bar. These plants, known as the American forge or Champlain forge, were generally ear a stream. Water power was used to operate the hammer, which consisted of an anvil and a heavy head attached to a long thick beam, hrough which was a shaft which acted as a fulcrum. A cam turned by the water wheel raised the hammer. Later steam was introduced nd the hammer head was raised by a vertical piston. The use of ydraulic forging presses is still more recent. These are now huge ools capable of exerting as much as 14,000 tons pressure. The rging machine is the latest development. The metal is shaped by es actuated by powerful gears. Dies are a very important develop- ent of the forging business, being used in various types of forging resses to form duplicate parts.

Cort's rolling inventions in England about 1783 gave England the mparative advantage, as the process is cheaper than forging. A scriminating import duty was placed in 1816 on rolled iron by the nited States to protect domestic forged iron against rolled iron.

For the higher grades of steel, forging is still employed in the rlier stages of advancement, as it works the metal better, producing finer grain. The automobile industry has been a great influence developing the drop-forging and cold-pressing industries. The ar caused the erection of a great number of forging plants for guns, ip shafts, armor plate, and projectiles, both in America and Europe.

Domestic production and consumption.—The United States is largest consumer and the largest producer of forgings. As sta above, statistics of production are not available, but the quanti of forgings imported have been but a small fraction of the dome output and during and since the war, at least, have been grea exceeded by the exports.

After the armistice there was a great idle surplus of forging equ ment in America, Canada, and Europe, and domestic production from 1,295,566 tons in 1918 to 534,246 in 1919. Stamping, a l important development, is treated in a survey entitled "Stamping

Domestic production is in excess of consumption, as in 1 $18,977,003 worth of forgings were exported and only $232,430 wo imported, which figures show that domestic producers supplied pr tically all the domestic market. The production in steel works 1918 was 1,295,566 tons; to this should be added production of o side forging plants, the production of which is large and probal more valuable per ton than forgings made in steel works.

Domestic exports.—Prior to 1918 forgings were included under " other manufactures of iron and steel" in Commerce and Navigati

In 1918 exports of forgings were valued at $37,476,769; in 1 they declined to $18,977,003. In 1918, a war year, the bulk of exports were to England and France, but in 1919 the shipments Canada amounted to nearly 70 per cent of the total, registering increase in value of over 210 per cent as compared with the previ year.

FOREIGN PRODUCTION.

The principal producing countries are England, France, Belgi Germany, and Canada.

IMPORTS.

Statistics of imports by countries are not available. Imports consumption in 1913 were valued at $182,623; the duty colle was $54,703. In 1919 the imports were valued at $236,547; the d was $28,385. Imports declined to about $40,000 per year du three years of the war but increased to $1,649,068 in 1918, of wh duties were collected on only $27,891, the imports being mostly Government use. Prior to 1914 and since 1910 imports have b fairly constant in value, probably consisting largely of parts foreign-made machines in use in the United States and other cialties.

Production of steel forgings in the United Kingdom in gross t 1915, 118,102; 1916, 351,266; 1917, 207,848; 1918, 286,512.

Great Britain imports more forgings than she exports. In 1 out of 21,556 tons of steel forgings imported, 19,231 tons imported from Germany. The figures of imports of steel forg from the United States are not given,[16] but of 1,838 tons of iron ings 1,190 tons were imported from the United States.

Exports of iron and steel in 1913 were 1,100 tons and in declined to 111 tons.

[16] Nat. Fed. I. & S. Mfrs. (British), Statistical Report, p. 6.

It would appear from prices of 1913 and 1919 that England can not compete either in the domestic market or in foreign countries with America in the base steel commodities. With this handicap it can not be expected that England can compete in the sale of forgings against the highly efficient tools and organizations of American producers.

Germany was evidently a competitive producer before the war, as she exported in 1913, 19,231 tons of steel forgings to Great Britain.

The production of forgings in Belgium in tons was: 1913, 8,220; 1914, 4,040; 1915, 620; 1916, 1,210; 1917, 240.

Italy produced 15,343 tons of armor plate and ordnance in 1913 and imported in that year 9,273 tons of forgings and 26,760 tons in 1918.

Canada imported from the United States in tons of forgings: 1913, 2,896; 1914, 1,439; 1915, 2,060; 1917, 6,369;[17] and a negligible amount from the United Kingdom.

PRICES.

Forgings are special products and it is impossible to present price data that will be representative of the whole group. The price of any forged article will depend upon (1) the character of the material, whether ordinary carbon steel, wrought iron, special-tool steel, or alloy steel; (2) the intricacy of the design (3) the degree of finish (rough hammered or swaged and smoothed); (4) the weight; and (5) the scale upon which the articles can be produced. The last factor is of great importance as quite complicated forgings may be produced relatively cheaply if they can be made and sold in sufficient quantity to justify the making of special dies and installing the requisite drop-forging machinery.

TARIFF HISTORY.

The general course of tariff legislation on forgings since 1894, has been a reduction of duty. In that year the rate was 1.5 cents per pound. In 1897 an ad valorem rate of 35 per cent was imposed; in 1909 it was reduced to 30 per cent, and in 1913 to 12 per cent. There has been an increase of imports coincident with these decreases of duty; from less than $1,000 a year in 1895 to 1897, to $27,551 in 1898, to $151,000 in 1909, to $281,981 in 1910, and $182,626 in 1913. The war imports were abnormal; those of 1919 declined to $28,385, which may be due to the bad conditions prevailing abroad, exchange, etc., due to the war. The increase of imports with the decrease of duty may have been due largely to the great growth of the industry in that time, if we had statistics to show the exports prior to 1918 this could be better seen. In 1897 an ad valorem duty covered forgings generally. In 1909 the restriction against advancement beyond the forging process was provided for. In 1913 materials for vessels of the United States were admitted free. $1,416,638 worth of forgings were admitted free in 1918. The Canadian duty is higher than the American, 37½ per cent with preferential duty in favor of the United Kingdom of 15 per cent. Canada is our principal foreign customer, importing from us $13,216,029 worth of forgings in 1919. France imported in 1918, $4,123,083 worth. The French import duty

[17] Nat. Fed. I. & S. Mfrs., Statistical Report, 1918.

is, general from 66 cents to 85 cents; minimum 44 to 57 cents, plus 4 per cent per 100 pounds. Germany imposes duties of from 11 cents to $1.43 per 100 pounds.

COMPETITIVE CONDITIONS.

The relatively small importation of miscellaneous forgings into the United States indicates that in recent years foreign producers have not introduced any serious competition in these articles. Most of the forgings that come under this general classification will be of special design. If the demand is sufficiently great for a certain type, it may be produced by drop forging—a machine operation. On account of larger consumption of many types of forgings in this country as compared with foreign countries, forgings made by a distinctly machanical process can generally be produced much more cheaply at home than abroad. Raw materials, except for Swedish iron which is now used in only very minor amounts in this country, can be obtained fully as cheaply as in other countries. Labor is a very important item in hand-forged articles, and the output per operative can not be very largely increased by improved equipment and organization in the United States. The cost of manufacture, therefore, for such articles as are made chiefly by hand, and this applies only to specialties for which the demand is comparatively small, is more nearly dependent upon the wages paid in the different countries. Forging labor in the United States is costly. The work is arduous and requires a high degree of skill and the workers are well paid. According to a study made by the United States Department of Labor [18] of the wages paid in various establishments producing machinery, the wages of blacksmiths in 1919 ranged from 60 to 70 cents per hour and those of helpers from 48 to 50 cents per hour.

In Great Britain, such work is generally done on piece rates; the earnings of blacksmiths on time rates can be taken at a trifle less than 2 shillings per hour and of helpers at about 1s 5d. These figures at standard exchange indicate that British wages in this work are about two-thirds those in the United States.

In France, wages of blacksmiths may be taken at from 25 to 30 francs per day of eight hours and of helpers, between 20 and 25 francs. At standard exchange these wages are almost exactly the same as American but in view of the depreciation in the franc, they now (August 1920) are only about one-third those paid in the United States.

The wages given above are for ordinary blacksmith work. In the production of certain classes of forgings, requiring special skill, the wages are much higher than the above figures indicate, but the comparison between the countries is doubtless about the same. In general, it may be said that European wages now are nominally at not greatly lower levels than American in this industry although, on account of the exchange situation, they are actually much lower. It remains to be seen whether foreign wages will come down with the strengthening of exchange.

An illustration of the importance of American inventiveness applied to the production of large quantities of forgings is the work of the Ford

[18] Monthly Labor Review, June, 1920.

Motor Co. on hollow axles for the Government during the war. These axles had cost over $200, being forged solid and then bored. But the Ford Co.'s engineers devised a method of producing them from tubes at a cost of only $48.

It would seem that the chief competition which the American forging industry must face is the output of superior qualities of steel castings. The latter industry has made rapid progress in late years and many parts formerly forged are now cast. Cort's invention of rolling resulted in displacing the forging process almost completely in the manufacture of simple sections and, with the improvement of practice in casting steel and the development of alloy-steel castings, it is possible that the field of forging will be still further restricted.

TARIFF CONSIDERATIONS.

The duty on highly advanced forgings is in some cases less than the duty on the unforged material used; forgings under paragraph 106 are dutiable at 12 per cent ad valorem, while under paragraph 110, special steels, ingots from which forgings are made are dutiable at 15 per cent. Other paragraphs are inconsistent, as:

Paragraph.	Commodity.	Duty.
106	Anchors	12 per cent ad valorem.
110	Pressed and stamped shapes and swaged steel, if made by the Bessemer or open-hearth process.	8 per cent ad valorem.
121	Axles (these may be of special steels)	10 per cent ad valorem.
126	Chain (these may be of special steels)	20 per cent ad valorem.
612	Die blocks, if made by the Bessemer or open-hearth process	Free.

As forgings vary greatly in design, material, treatment, and value ad valorem duties seem more applicable than specific duties.

There has been an increase of imports with the reductions of import duties from $1,000 a year in 1895 to $182,625 in 1913.

Forged iron and steel by rolling mills and steel works[1]*—Production in United States.*

[From Annual Statistical Report of the American Iron and Steel Institute.]

Year.	Iron.	Steel.	Total.	Year.	Iron.	Steel.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*		*Gross tons.*	*Gross tons.*	*Gross tons.*
1906	19,148	333,488	352,636	1913	27,892	380,091	407,983
1907	23,772	357,033	380,805	1914	3,675	337,746	341,421
1908	13,646	117,497	131,143	1915	2,814	520,909	523,723
1909	25,523	223,741	249,264	1916	3,352	920,415	923,767
1910	20,410	299,452	319,862	1917	8,772	1,069,993	1,078,765
1911	4,034	214,202	218,236	1918	24,458	1,271,108	1,295,566
1912	9,155	383,365	392,520	1919	23,822	510,524	534,346

[1] This does not include forgings made outside of steel works, probably the most valuable tonnage.

All forged or other iron and steel products not otherwise enumerated—Production in United States.

[From Federal Census, 1914.]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Gross tons.			*Gross tons.*	
1899	81,009	$6,665,741	1909	365,986	$18,740,241
1904	274,061	15,684,967	1914	411,402	19,165,900

Axles, rolled or forged[1]*—Production in United States.*

[From Federal Census, 1914.]

Year.	Quantity.	Value.	Year.	Quantity.	Val
	Gross tons.			*Gross tons.*	
1899	102,606	$4,482,937	1909	102,348	$3,8
1904	83,585	2,875,829	1914	[1] 89,436	3,4

[1] Includes 1,160 tons of axles other than car and locomotive (automobiles, carriages, etc.), valued at $

Armor plates, gun forgings, and ordnance—Production in United States.

[From Federal Census, 1914.]

Year.	Quantity.	Value.	Year.	Quantity.	Val
	Gross tons.			*Gross tons.*	
1899	15,302	$7,526,479	1909	26,845	$10,6
1904	24,433	10,549,620	1914	38,669	19,9

Forgings of iron or steel, or of combined iron and steel but not machined, tooled, or o wise advanced in condition by any process or operation subsequent to the forging p not specifically provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu comp ad va ra
		Pounds.				*Per*
1910 [1]	30 per cent		$281,869.83	$84,560.95		
1910	Duty remitted; sec. 23, act Aug. 5, 1909.		112.00			
1911	30 per cent		137,159.00	41,147.70		
1912	do		134,037.00	40,211.10		
1913	do		182,345.90	54,703.77		
1913	Duty remitted; Panama act.		281.00			
1914 [2]	30 per cent		29,707.00	8,912.10		
1914 [3]	12 per cent		120,632.00	14,475.82		
1915	do		40,102.00	4,812.24		
1915 [4]	Free		4,519.00			
1916	12 per cent		40,265.00	4,831.80		
1916 [5]	Free; sec. IV, J5		45.00			
1917	12 per cent		37,302.00	4,476.24		
1918	do		232,430.00	27,891.60		
1918 [5]	Free; sec. IV, J5		9,633.00			
1918 [4]	Free; C. R., art. 392.		1,407,005.00			
1919	12 per cent	3,329,706	236,547.00	28,385.64	0.062	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1, to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[4] For use of the United States.
[5] For the construction and equipment of vessels.

Forgings of iron or steel, or of combined iron and steel, not specifically provided for—Imports for consumption—Revenue.

Fiscal year.[1]	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1894	2½ cents per pound	186,020	$9,070.00	$4,278.45	$0.049	47.17
1894	do	1,081	60.00	24.87	.056	41.45
1895	1¼ cents per pound.	15,881	610.39	238.23	.038	39.05
1896	do	12,030	498.00	180.45	.041	36.23
1897	do	967	30.50	14.51	.031	47.57
1898	do					
1898	35 per cent		27,551.00	9,642.85		35.00
1899	do		40,561.00	14,196.35		35.00
1900	do		72,323.00	25,313.05		35.00
1901	do		60,895.00	21,313.25		35.00
1902	do		71,548.20	25,041.87		35.00
1903	do		58,095.00	20,333.25		35.00
1904	do		36,041.00	12,614.35		35.00
1905	do		35,834.00	12,541.90		35.00
1906	do		70,748.00	24,761.80		35.00
1907	do		190,105.49	66,536.92		35.00

[1] Ended June 30.

Forgings, antifriction ball forgings of iron or steel or of combined iron or steel—Imports for consumption—Revenue.[1]

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1901	45 per cent		$11.00	$4.95		45.00
1902	do		2,646.00	1,190.70		45.00
1903	do		3,076.00	1,384.20		45.00
1904	do		2,194.00	987.30		45.00
1905	do		3,602.00	1,620.90		45.00
1906	do		1,458.00	656.10		45.00
1907	do		47,818.00	21,518.10		45.00

[1] Imports and duties, Evans, p. 563.

Forgings, n. e. s.—Domestic exports (fiscal years).

Exported to—	1918	1919	Exported to—	1918	1919
France	$5,254,194	$4,123,083	Cuba	$52,704	$12,131
Italy	834,731	764,587	Japan	52,626	171,288
Switzerland	82,616	52,050	All other	323,330	289,570
United Kingdom	26,771,644	348,270			
Canada	4,104,924	13,216,024	Total	37,476,769	18,977,003

[1] Included in "All other manufactures of iron and steel" prior to 1918.

Court and Treasury Decisions.

Comparing paragraph 127 of the act of 1897 with paragraph 123 of the act of 1909, and taking into consideration what would appear to be a legislative intention with respect to paragraph 123, as evidenced by its history, a forging is advanced in condition when the burr on the edge of the rough-forged article is removed by passing it over a grindstone, and a hoe rough forged, but so manipulated, was held dutiable under paragraph 123. (United States *v.* Anderson & Co., 2 Ct. Cust. Appls., 350, of 1911.)

Steel piston rods which had been rough-machined and not further advanced than close forged were declared to remain forgings of

eel under paragraph 127 of the act of 1897 (Prosser *v.* United Stat Ct. Cust. Appls., 550, of 1911), as were also drawplates and wort rged from the ingot through various stages and reaching the fi hape in which they were delivered to the consumer, the adjust rocesses to which they were necessarily subjected being mer ncidental to the common use of drawplates and wortles (Newm . United States, 2 Ct. Cust. Appls., 4 of 1911, and cases cite The Court of Customs Appeals in that case, at pages 7 and 8, sa

What constitutes forgings has likewise been the subject of much discussion in courts. The highest and perhaps the most satisfactory deliverance on the sub was by the Supreme Court of the United States in Saltonstall *v.* Wiebusch (156 S., 601). The subject of that decision was scythes and grass hooks made out of pieces of metal which were shaped by forging, but which required in addition ther in order to make them ready for their intended use, the application of other proce than forging. The question was whether they were dutiable as forgings or as arti of steel partly manufactured. While the statute under consideration by the c differed in language from the present, the terms defined are the same. The c said:

"From the separate enumeration of 'forgings of iron and steel' and 'forged of whatever shape or in whatever stage of manufacture,' it would seem that Cong intended to distinguish between the two and to apply the term 'forgings,' tho perhaps not exclusively, to such articles as are completed by the action of the ham Hence we are not prepared to accept the theory of the Government in this case the articles in this paragraph are confined to such as are incomplete or in pro of manufacture, as there may be many articles which would naturally fall within designation of 'forgings' which are finished and ready for use—such, for exampl ornamental ironwork, wrought-iron railings, and grilles, none of which are subje to any further process of manufacture. This view is strengthened to a certain ex by the separate enumeration in the same schedule of anvils, anchors or parts the mill irons and mill cranks, of wrought irons and wrought iron for ships, and forg of iron and steel for vessels, steam engines, and locomotives, or parts thereof * *

Apparently all of these fall within the same category of forgings and apply to pleted articles.

But we do not understand the term "forgings" to be applicable to articles w receive treatment of a different kind than hammering before they are comple such, for example, as grinding, tempering, or polishing—though the witnesses ag that welding and punching are properly forging processes.

Black and unpolished shovel blades made by the forging pro are dutiable at 12 per cent under paragraph 106 of the act of 1 as "forgings of iron or steel * * * not * * * advanced condition by any process or operation subsequent to the for process," rather than free of duty under paragraph 391 as agri tural implements (G. A. 8159, T. D. 37605 of 1918). Steel balls further advanced than the forging process, used for crushing cer or ores, were held dutiable under paragraph 106 as forgings of s not as ball bearings (Abstract 38032 of 1915). The words "finis or unfinished, and parts thereof," in paragraph 105, apply to finis or unfinished ball bearings and also to parts of finished or unfinis ball bearings, and include raceways so far finished as to indi per se their ultimate use and whose shape and condition unfit t commercially for any other use (Norma Co. of America *v.* Un States, 6 Ct. Cust. Appls., 13, of 1915).

Articles of different classes and of greatly different duties are c bined in paragraph 106 of the act of 1913. Moreover, forgings 12 per cent under that paragraph, while the steel from which they made pays 8 or 15 per cent under paragraph 110, according to process of manufacture.

Forgings—Rates of duty.

Act of— Year.	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	163	* * * forgings of iron and steel for vessels, steam engines, and locomotives, or parts thereof, weighing each 25 pounds or more.	2 cents a pound.
	167	Forgings of iron and steel, or forged iron, of whatever shape, or in whatever stage of manufacture, not specially enumerated or provided for in this act.	2½ cents a pound.
1890	139	Forgings of iron or steel, forged iron and steel combined, of whatever shape, or in whatever stage of manufacture, not specially provided for in this act. *Provided*, That no forgings of iron or steel, or forgings of iron and steel combined, by whatever process made, shall pay a less rate than 45 per cent ad valorem.	2.3 cents per pound.
	153	* * * forgings of iron or steel, or combined iron and steel, for vessels, steam engines, and locomotives, or parts thereof, weighing each 25 pounds or more.	1.8 cents per pound.
1894	115	Forgings of iron or steel, or forged iron or steel combined, of whatever shape, or in whatever stage of manufacture, not specially provided for in this act. *Provided*, That no forgings of iron or steel, or forgings of iron and steel combined, by whatever process made, shall pay a less duty than 35 per cent ad valorem.	1½ cents per pound.
	126	* * * forgings of iron or steel, or combined iron and steel, for vessels, steam engines, and locomotives, or parts thereof.	1.2 cents per pound.
1897	127	* * * forgings of iron or steel, or of combined iron and steel, of whatever shape or whatever degree or stage of manufacture, not specially provided for in this act.	35 per cent ad valorem.
		Antifriction ball forgings of iron or steel, or of combined iron and steel.	45 per cent ad valorem.
1909	123	* * * forgings of iron or steel, or of combined iron and steel, but not machined, tooled, or otherwise advanced in condition by any process or operation subsequent to the forging process, not specially provided for in this section.	30 per cent ad valorem.
		Antifriction balls, ball bearings, and roller bearings of iron and steel or other metal, finished or unfinished.	45 per cent ad valorem.
1913	106	* * * forgings of iron or steel, or of combined iron and steel, but not machined, tooled, or otherwise advanced in condition by any process or operation subsequent to the forging process, not specially provided for in this section.	12 per cent ad valorem.
		Antifriction balls, ball bearings, and roller bearings of iron or steel or other metal, finished or unfinished, and parts thereof.	35 per cent ad valorem.
1913	.....	J. subsection 5: That all materials of foreign production which may be necessary for the construction of naval vessels or other vessels of the United States, vessels built in the United States for foreign account and ownership, or for the purpose of being employed in the foreign or domestic trade, and all such materials necessary for the building of their machinery, and all articles necessary for their outfit and equipment, may be imported in bond under such regulations as the Secretary of the Treasury may prescribe; and upon proof that such materials have been used for such purposes no duties shall be paid thereon.	

ANTIFRICTION BALLS AND BALL BEARINGS.

[Par. 106, Act of 1913, 35 per cent.]

SUMMARY.

RELATION OF DOMESTIC PRODUCTION AND IMPORTS.

In 1913 the domestic industry produced a total which may be estimated at $6,631,000. In 1917 the production may be estimated as twice as great.

In roller bearings the United States is self-sufficient, producing enough for domestic needs. The roller bearing is a distinctively American product, not used to a great extent in Europe, and manufactured by only a single firm there—at Manchester, England.

A considerable portion of the supply of ball bearings has been imported, both before the war and during its continuance. The weight or number of these imports is not recorded; in value, they have amounted to approximately $1,500,000 per year. This forms 23 per cent of the estimated domestic production of ball and roller bearings in 1912. These imports are standardized articles, competing with the domestic bearings, and put to use in the same articles as the domestic. They are not of a quality in any way superior to the domestic manufactured ball bearing.

EFFECTS OF THE WAR.

The war has cut off the importation of ball bearings from Germany, and Sweden has taken its place as an exporter to the United States. It has not been ascertained to what extent this trade has been in German bearings reexported from Sweden. It is probable that they make up some part of it. The growth of the import trade with Sweden previous to the war, and the need of Germany for ball bearings which has resulted from the war, make it unlikely that German reexports form an important part in this trade.

Two other foreign competitors in our markets are Italy and the United Kingdom. Some of the Italian firms are German owned. The import from the United Kingdom still continues, although it has been greatly cut down by the war.

Proportionately to needs, the import of ball bearings has been greatly decreased by the war. The fairly steady value of the import represents, at the present prices, a smaller number of bearings. War has meant a demand for a greatly increased number of bearings, and the American manufacturers have met this demand by the extension of their industry, while stocks in the country have been depleted.

Thousands of our trucks have gone to Europe equipped with roller bearings the manufacture and use of which has been confined to the United States and American-made products. They have thus received wide advertisement, and imitation may be expected to follow.

SIGNIFICANCE OF THE DUTY.

The duty has been one which yielded a steady revenue of some size. At 45 per cent ad valorem under the act of 1909 this amounted to some $675,000 yearly; at 35 per cent under the act of 1913 to June 30, 1917, to $525,000. Whether under normal conditions the change in duty would have resulted in a sufficient increase in imports to offset the lower rate it is impossible to say, for the effects of the war make this factor a minor one. Imports at least show no decided reduction until after the third quarter of 1917, six months after the United States entered the war.

The reduction of the duty by the act of 1913 was followed by a drop in the price of the foreign bearings imported.

The duty is of only future significance for the roller-bearing manufacturers, for the European competition which may be expected in this product has not arisen. The ball-bearing industry, which has increased in importance so rapidly since the beginning of the war, with the installation of modern methods and machinery, will be subjected to immediate competition from foreign firms seeking to regain lost markets. The ability of the American firms to meet this competition is dependent (under the same rate of duty) upon the increased efficiency which has come with the expansion of the industry. In this respect it may be noted that expansion has been accompanied by only a moderate price increase.

Antifriction balls and bearings—Summary table.

Year.	Domestic production.	Ratio of imports to production.	Value (imports for consumption).	Amount of duty.	Equivalent ad valorem rate.
		Per cent.			*Per cent.*
1910			$1,326,922.00	$597,114.90	45
1911			1,083,894.00	487,752.30	45
1912	[1]$6,631,000	[2]22.8	1,508,939.00	679,022.55	45
1913			2,014,708.00	906,618.60	45
1914			1,684,810.00	636,113.90	37.76
1915			1,528,331.00	534,915.85	35
1916			1,530,523.00	535,683.05	35
1917			1,542,230.00	539,779.45	35
1918			973,098.00	340,584.30	35
1919			256,314.00	89,709.90	35
1920			1,014,297.00	355,004.00	35

[1] Estimate of Mr. Joseph H. Auerbach, United States Tariff Commission's files.
[2] On basis of estimate.

General Information.

PARAGRAPH 106, ACT OF 1913.

"* * * antifriction balls, ball bearings, and roller bearings, of iron or steel or other metal, finished or unfinished, and parts thereof, 35 per cent ad valorem." (P. 42.)

DESCRIPTION.

Kinds.—Antifriction bearings consist of either balls or rollers, fitted between two metal cases in such a way that a shaft may be inserted into the inner case and the outer case into the bearing frame, the contact between the stationary and fixed parts thus being through

the balls or rollers. This arrangement substitutes a rolling contact for the sliding contact of the ordinary bearing, thus reducing the friction.

The radial ball bearing carries a load at right angles to the shaft; the thrust ball bearing, one parallel to it: the cup and cone ball bearing, a combination of both; similarly, the straight, thrust, or tapered roller bearings sustain, respectively, radial, thrust, or compound loads.

Ball and roller bearings are made in standard sizes, and in three grades—light, medium, and heavy—for a given diameter of bore. (See pp. 40–41 for standard measurements.)

Uses.—The automobile industry is the largest consumer of ball and roller bearings. In 1913 it was estimated that it consumed 90 per cent of the production. (P. 6, Auxiliary file.) They are used also in bicycles, aeroplanes, and in machinery, wherever their substitution for a sliding bearing is possible and economical, and the elimination of friction is desirable.

DOMESTIC PRODUCTION.

The industry is of considerable size; its importance is derived from the widespread use of antifriction bearings, especially in automobiles and aeroplanes.

Materials.—The balls and rollers, and the races and rings, as the other parts of the bearing are called, are usually made of chrome steel, though other metals, as bronze, are sometimes used. This steel comes either in bars or wire, depending on the size of the ball to be produced. (Auxiliary file, United States Tariff Commission, p. 2.)

Prior to the war a quantity of this alloyed steel was imported from Germany.

Methods of production.—The primary element of the bearing is the balls or the rollers. The balls are forged or turned, and are then subjected to a series of very careful grindings which give them a sphericity and accuracy to a thousandth part of an inch. During this process they are carefully tempered, in order to produce the tough and close-grained metal desired. The rollers are turned, tempered, and ground in a similar manner. The sleeves within which the balls or rollers are placed are forged, cut from tubing, or, in the smaller sizes, turned. They are tempered and subjected to a grinding process similar to that used for the balls and rollers. The simplest form of radial ball bearing consists of two concentric rings of metal, the inner grooved on the outside, the outer on the inside. The balls run in these grooves, the rings fitting snugly upon them. This arrangement necessitates the forcing in of the last few balls placed between the rings and holds the bearing together when not placed in a machine. The balls are held apart by a loose-fitting device between the rings.

For each diameter of the bore—manufactured in millimeter or inch measurements—ball bearings are made in three series, light, medium, and heavy. Ball bearings are thus a standardized product, the manufacturers competing in quality and price rather than design, although differences exist. The design of roller bearings is less thoroughly standardized.

[1] Radial ball bearings can take a certain amount of thrust load.

Organization.—The total investment in the industry was estimated at $9,000,000 in 1913. There are 25 firms listed as manufacturing roller bearings and 51 as manufacturing and importing ball bearings, 7 firms appearing on both lists. The total number of firms listed is thus 69. The industry is one of many units, several of them, however, being large establishments.

Geographical distribution.—Firms manufacturing antifriction balls and bearings are located in New York, Pennsylvania, Connecticut, Ohio, Illinois, Massachusetts, Michigan, and a few other States. Firms are thus located in the important industrial sections. The importers of ball bearings are located largely in New York City, and the manufacturers of this product are pretty well scattered in the States named. The roller-bearing firms are more concentrated, 14 firms of the 25 being evenly divided between Ohio and Pennsylvania. These firms have thus become concentrated in the vicinity of their market—the manufacturers of electric cars, tram cars, and heavy machinery.

History.[2]—The first commercial steel balls were made in this country under basic patents granted to Richardson of the Waltham Emery Wheel Co., Waltham, Mass., in 1887. In 1890 the Cleveland Machine Screw Co., of Cleveland, Ohio, which furnished the bulk of the ball bearings used in the bicycle trade, designed and built for the Deutsche Waffen und Munitions Fabriken of Berlin, Germany, the equipment used in its original steel ball plant. This company, previous to 1914, had furnished balls for the bulk of the bearings used here.

Before 1900 the bicycle industry was the big user of ball bearings. With its decline a number of the firms manufacturing ball bearings failed, and in 1901 the Standard Roller Bearing Co., of Philadelphia, Pa., acquired all properties.

Recent expansion of the industry has accompanied the development of the automobile since 1910 and the demand arising from the war, both for automobiles and aeroplanes. This increased demand has been met by the use of stocks then in the country, the establishment of new companies, and extension of old plants.

Domestic production and consumption.—Consumption for 1912 was estimated at $9,759,000, of which the United States produced $6,631,000, or approximately 70 per cent. Production includes roller bearings. These were imported in appreciable quantities only after January 1, 1917.

Prior to the war the United States thus produced roller bearings sufficient for its own consumption and balls and ball bearings in a lesser degree. Since the war its productive capacity was probably doubled, while stocks of domestic and foreign bearings have been depleted yearly. Imports remained about the same in value to June 30, 1917, quantity meanwhile decreasing; since that date the value of the imported bearings has decreased.

Exports.—Exports are not specified in the statistics of Commerce and Navigation. They have been small, some bearings going to Australia and Sweden, and balls to Japan.

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[2] A. E. Hammond, in Machinery, vol. 23, p. 99ff, March, 1917. Also, Hoover Steel Ball Co., The Evolution of the Steel Ball Industry, pp. 9-11.

FOREIGN PRODUCTION.

The chief foreign producers of ball bearings are Germany, Sw Great Britain, Switzerland, and Italy. Great Britain has a manufacture of balls, exported to the continent to a large exte assembling into bearings. The only European roller-bearing fa is located in England.

There are six firms engaged in the manufacture of ball and bearings in the United Kingdom. Three of these make their balls, while the others make bearings, purchasing their balls from the other three or from abroad. Most of the trade, howev in the hands of two large producers. One of these firms has be business for about 20 years, being established about the same as the first German company. There is only one manufactur roller bearings at the present time, but another large corporati on the verge of putting another British roller bearing on the ma

The largest establishments are organized for mass production have sufficient experience in this rather difficult art to pro economically. There has been a great increase in the total ou of these articles since 1914, but it has scarcely kept pace with rapid increase in the home demand. This to a large extent exp the importation of American balls and bearings which are now sold in great quantities in the United Kingdom. British manu turers, however, predict that the projected increase in plant shortly result in their being able to supply the home market leave a surplus for export. They do not believe that any consider fraction of this surplus will find its way to the United States, as rather expect that the adjustment of prices in the United King will probably depend upon the pressure of American competitio that market. The British home market is relatively small as pared with that of the United States, where the demand for bearings is enormous. It is doubtful if any of the British prod put together are likely to attain to production rate of even one o largest bearing manufacturers in the United States, where as m as 12,000 complete bearings are turned out in one day. Prior t outbreak of the war, 65,000 sets of ball bearings were imported Great Britain per day, chiefly from Germany. War developmen the industry indicated that the United States has now become largest producer of both ball and roller bearings in the world, the United Kingdom is second with a more rapidly increasing ou as compared with Germany, which may now be expected to take place.

British manufacturers have a working agreement as to prices, do not maintain a central sales organization. On account of enormous demand for their products during and after the war, strength of the agreement between the firms has not yet been p the test, but it does not seem likely that it will be for some tim come. It is interesting to note, furthermore, that the Skefko Bearing Co., which is one of the largest British manufacturers, is tically a subsidiary of the Hess-Bright Co. in the United States, this affiliation may be expected to have an important influence Anglo-American trade in these articles. [Extract from British Report of United States Tariff Commission.]

many has had an advantage in the production because of ally skilled workmen, able to produce a product of great accuracy.

IMPORTS.

antity.—Under the act of 1909 (Aug. 6, 1909–Oct. 3, 1913) rts of antifriction balls and bearings for consumption amounted pproximately $1,535,000 per year. Under the act of 1913 to 30, 1917, they amounted to approximately $1,550,000 per year. e is no marked decrease in imports for consumption until after 30, 1917. For the year following this date they were only ,100. The steadiness of the value of imports is accompanied sing prices, so that the actual number of bearings imported is asing.

incipal contributing countries.—Previous to the war, the chief tries exporting to the United States were Germany, Italy, the ed Kingdom, and Sweden. Germany contributed 76 per cent e total import, 1910–1914, Sweden, 8 per cent. Now Sweden is principal contributor, followed by the United Kingdom and zerland. In the years 1915–1917, 17 per cent of the total import from Germany (all in 1915), and 73 per cent from Sweden.

asses and varieties.—Under the act of 1913, antifriction balls and ings are classified into balls, ball bearings, roller bearings, and s. Ball bearings formed by far the largest portion of the import— per cent, October 4, 1913, to June 30, 1917. Balls formed 2.93 ent of this total, parts 0.64 per cent, roller bearings 0.19. During fiscal years 1916–1918, imports of roller bearings and parts have increasing, imports of balls and ball bearings decreasing. In , ball bearings formed 93.3 per cent of the total, balls 2.6 per cent, s 2.2 per cent, and roller bearings 1.9 per cent.

aracter.—The imported bearings are standardized like the Ameri- article—the Germans used the same standard price list as that in here—and enter into direct competition with the American uct. They are used principally in automobiles; some in machine and other machinery. The low-class bearing—that used in gers, washing machines, roller skates, baby carriages, etc.—is not rted. Neither is there competition in roller bearings, which have developed in this country and are a distinctively American uct.

venue.—Under the act of 1909, with a 45 per cent duty, the total nue was $2,879,445.15, and under the act of 1913, with a 35 per duty, the total revenue up to June 30, 1917, was $2,037,555.45. is approximately $675,000 per year under the first act and $525,- nder the second, on a yearly import slightly greater.

comparison between imports under the act of 1909 and that of does not show the effect which the lowering of the duty on riction balls and bearings from 45 to 35 per cent would have ally had, since import was more vitally affected by war condi- after 1914 than by the duty. That even under war conditions rts kept up as well as they did seems to show a consistent demand reign bearings in this country, which would prevent decrease in rts under a higher rate, and thus make that higher rate more uctive of revenue.

PRICES.

Domestic.—Ball and roller bearings are sold according to standard list prices, from which certain discounts are made. Two such lists are given on pages 40–41—one in force from the outbreak of the war till April, 1918; the other since that date. One company calculated the increase in list price of 10 leading sizes. On the old list the average of these sizes was $1.21; on the new, $1.51. The same company calculates their average sale price in 1913 at $1.22; in 1917 at $1.50, an increase of 15 per cent.

Foreign.—The German average price prior to the war corresponding to the average list price on the old list given above ($1.21) was calculated by the same company to be $0.684 plus freight and duty previous to the war.

One company states that before the act of 1913, foreign prices were 10 to 15 per cent under domestic.

TARIFF HISTORY.

United States.—Prior to the act of 1897, antifriction balls and bearings were not specified in the tariff acts. That act provided that antifriction ball forgings of iron or steel, or combined iron or steel, should pay a duty of 45 per cent ad valorem. Finished bearings would not come under this provision, but would bear an equal duty as manufactured goods of iron or steel not specially provided for. The act of 1909 brought all balls, ball bearings and roller bearings, under one provision, leaving the rate 45 per cent. This the act of 1913 lowered to 35 per cent.

Foreign duties.—Canada, Australia, Cuba, and Japan levy an ad valorem duty. In the latter country it is 20 per cent. The Canadian duty varies; it is 37½ per cent on thrust bearings (British preferential rate 25 per cent), on bronze balls for bearings and on balls of forged chrome steel. On universal joint ball bearings and radial bearings (if substantially iron or steel) it is 35 per cent (British preferential tariff 20 per cent). On steel balls adapted for use on bearings it is 17½ per cent (British preferential tariff 5 per cent). Australia admits British ball and roller bearings free; others under a duty of 10 per cent. The Cuban duty is 25 per cent; 20 per cent on those from the United States. Mexico admits them free.

The Swedish specific duty is graded according to weight, varying from 18.2 cents per pound to 2.4 cents. The French tariff is arranged according to diameter and varies from 19.3 to 3.2 cents per pound. The German duty is 2.6 cents per pound on finished steel balls; 10.8 cents per pound on parts of cycles.

COMPETITIVE CONDITIONS.

In the manufacture of roller bearings, competition from foreign manufacturers is a matter of the future. Formerly roller bearings were not looked on with favor in Europe. Through the advertisement which they have received from the automobiles and trucks sent to Europe during the war, European manufacture is expected in imitation of the American, and having the same advantages which the Europeans have in the making of ball bearings. The offset to such advantages will be the earlier start and organization of the industry here.

In the manufacture of balls, Great Britain leads, making, it has been estimated, 50 per cent of the balls used in the manufacture of ball bearings. These balls are exported to Germany and other European countries, and to some extent to the United States. Balls are likewise imported into this country from Germany.

Ball bearings, which form over 90 per cent of our imports, came, prior to the war, chiefly from Germany; now from Sweden, Switzerland, Italy, and to a less extent Great Britain. The superiority of the foreign product has been due to the greater accuracy of manufacture which could be maintained with cheaper and more skillful labor. This skill was of a nature not possessed by the laborer of this country and was handed down from father to son.

War conditions have resulted in a complete change in the situation. The demand has expanded enormously, at a time when imports from Europe, if remaining fairly constant in value, were declining in quantity. A very much increased domestic production has been the result. This has been the result in the case of roller bearings, though previous to the war the domestic production supplied the market. The effects of the war chief in importance for this industry has been the advertisement such bearings have received, which may result in imitation and competition.

In the case of ball bearings, and possible future European production of roller bearings, post-war competition will be of a different nature than prewar; the European has been taught the American methods of quantity production, and their application to small fabricated steel products has taken place to some extent, and is to be expected to a greater extent since the ending of the war. Automatic machinery has been installed and skilled labor has been trained in quantity production through the experience which they have gained in the making of munitions. Some of this is female labor, often cheap. European industry, formerly characterized by the production of superlatively exact work, has now taken on American characteristics.

The growth of American industry has taken place with the application of methods of quantity production. The price increase during the war period has been relatively slight—15 per cent, by one computation.[2] "So small a relative increase in price is, of course, only possible through greatly increased volume of business which permitted the application of extensive economies in operation."

High quality has been developed with this expansion. The American industry will have the advantage of being on the ground and the start it has gained in its expansion, as against the lower wages of Europe.

TARIFF CONSIDERATIONS.

Requests for an increase of the duty on steel balls and ball and roller bearings began in 1909. It was claimed that the foreign manufacturer produced them cheaper, while the increase of the price due to the tariff would not affect the price of the finished machine in which the bearings were used to any great extent. They were used chiefly in automobiles, which were a luxury. The Packard Motor Car Co. stated that the German bearings were superior to the Ameri-

[2] Fafnir Bearing Co., letter of Nov. 19, 1918.

can, but that a duty should be imposed to give the American manufacturers a chance to make better bearings.

In 1913 the retention of the 45 per cent duty of the act of 1909 was urged on the ground that German costs were less, and there was a large sale of German bearings in this country. It was estimated that the total price of all the German bearings sold here was one-third of the total price of all bearings sold. The J. S. Bretz Co., of New York City, presented a brief signed by nine other companies which imported ball bearings, asking a reduction of duty from 45 to 35 per cent. It urged that American bearings were underselling German, and such a reduction would still keep the price of foreign bearings above American.

In 1918, in response to a circular letter sent out by the commission, letters were received from the manufacturers of ball and roller bearings and users of ball bearings. They call attention to the connection between the manufacture of balls and ball bearings and the steel industry in Germany and the help given the industry by the Government. The machinery is designed on American lines, and the workers receive less pay than the American. During the war, in the absence of foreign ball bearings, the American product has developed greatly. The difference between the American and the foreign ball bearing is one of price, not quality.

The ball-bearing industry has received a great stimulus from war activities, and seems to have produced an article now equal to the foreign in quality. The domestic industry will doubtless face an attempt on the part of European manufacturers to regain the market, but occupies a more advantageous position to meet such competition than before the war. Evidence regarding the greater cheapness of the foreign ball bearing is conflicting, but imports seem to be best explained on the ground of the lower price of the foreign article. European production for import to the United States, however, has been under a sufficient disadvantage to lead to the establishment of plants in this country by foreign producers.

An equal rate of duty has fallen upon ball and roller bearings. The latter have had a position on the American market differing entirely from the former; they have been an American product, holding the domestic market, and imported to only a very slight extent. The European consumer has preferred the ball bearing, with its great theoretical efficiency. The United States manufacturer has developed the roller bearing; especially the taper roller bearing, used in the front wheels of automobiles. The duty on roller bearings is thus a nominal one at present. The manufacturers feel that their product has received advertisement in Europe, and that imitation, with European advantages in manufacture, will follow.

The duty, which falls almost entirely on balls and ball bearings, yields a sufficient revenue to be of importance from that point of view. The decrease in revenue following the lowering of the duty from 45 to 35 per cent seems to indicate that the latter rate is not at the point of maximum revenue, although the import was subject to influences arising from the war to a greater extent than it was affected by the change in rate.

Antifriction balls and bearings [1]—Imports by countries (fiscal years).

Imported from—	1911	1912	1913	1914	1915	1916
a-Hungary	$6,951	$4,639	$28,666	$3,593		
m	5,093	14,099	2,847	2,826	$10	
ark		1,456				
e	30,811	17,751	45,300	25,915	3,767	
any	969,970	1,304,672	1,793,697	1,419,919	750,462	
	175,208	105,727	186,674	76,117	77,051	$441
rlands		141	1,931	4,634	32,653	1,606
n	28,554	91,742	244,367	235,931	524,455	1,317,488
erland	8,829	7,663	43,544	52,335	91,820	1,386
d Kingdom	44,604	47,652	62,310	76,128	39,819	34,840
ia	3,720	8,986	1,525	2,294	7,695	47,802
o		39				
undland and Labrador				3		
pine Islands		4				
Total	1,273,740	1,604,571	2,410,861	1,899,695	1,527,732	1,403,563

Imported from—	1917	1918	1919	1918 [2]	1919 [2]
e		$235	$264		$264
rlands					611
ay		21,371			
n	$1,312,041	1,242,553	354,414	$930,473	378,530
erland	130	97	58,596		58,596
d Kingdom	2,597	2,947	55	880	55
ia	64,941	22,110	15,172	22,231	11,093
na		20		29	
undland and Labrador		73			
	33				
alia		10		10	
Total	1,379,742	1,289,416	428,501	953,614	449,149

[1] Included in "All other manufactures of" prior to 1911. [2] Calendar year.

ings of iron or steel, or combined iron and steel—Antifriction balls—Imports for consumption—Revenue.

scal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
	45 per cent		$127,064	$57,178.80		45.00
	do		429,649	193,342.05		45.00

ngs—Antifriction balls, ball bearings, and roller bearings of iron or steel or other metal, finished or unfinished—Imports for Consumption—Revenue.

cal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
	45 per cent		$1,326,922	$597,114.90		45.00
	do		1,083,804	487,752.30		45.00
	do		1,508,939	679,022.55		45.00
	do		2,014,708	906,618.60		45.00
	do		464,304	208,936.80		45.00

6, 1909, to June 30, 1910, under act of 1909.
1 to Oct. 3, 1913, under act of 1909.

Forgings—Antifriction bearings of iron or steel or other metal, finished or unfinis
Balls—Imports for consumption—Revenue.

BALLS.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actua comp ad val rat
						Per c
1914 [1]	35 per cent		$75,900	$26,565.00		
1915	do		30,989	10,846.15		
1916	do		33,333	11,666.55		
1917	do		30,609	10,713.15		
1918	do		25,558	8,945.30		
1919	do		30,623	10,718.05		
1920	do		259,823	90,938.05		

BALL BEARINGS.

1914 [1]	35 per cent		$1,124,830	$393,690.50		
1915	do		1,494,583	523,104.05		
1916	do		1,495,363	523,377.05		
1917	do		1,488,095	520,833.25		
1917 [2]	35 per cent less 20 per cent		15	4.20		
1918	35 per cent		907,870	317,754.50		
1919	do		187,033	65,461.55		
1920	do		619,399	216,789.65		

ROLLER BEARINGS.

1914 [1]	35 per cent		$136	$47.60		
1915	do		105	36.75		
1916	do		5	1.75		
1917	do		10,678	3,737.30		
1918	do		18,636	6,522.60		

PARTS THEREOF.

1914 [1]	35 per cent		$19,640	$6,874.00		
1915	do		2,654	928.90		
1916	do		1,822	637.70		
1917	do		12,833	4,491.55		
1918	do		21,034	7,361.90		
1919	do		38,658	13,530.30		
1920	do		134,075	46,926.25		

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Reciprocity treaty with Cuba.

Forgings of iron or steel, or combined iron and steel—All other, not specifically prov
for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual comp ad val rat
						Per c
1908	35 per cent		$84,343.00	$29,520.05		
1909	do		151,095.50	52,883.43		
1909 [1]	35 per cent less 20 cent.		45.00	12.60		
1910 [2]	35 per cent		29,816.00	10,435.60		

[1] Reciprocity treaty with Cuba.
[2] July 1 to Aug. 5, 1909, under act of 1897.

Forgings, of iron or steel, or of combined iron and steel, but not machined, tooled, or otherwise advanced in condition by any process or operation subsequent to the forging process, not specifically provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1913[1]	30 per cent		$281,869.83	$84,560.95		30.00
1909	Duty remitted (sec. 23, act Aug. 5, 1909).		112.00			
1911	30 per cent		137,159.00	41,147.70		30.00
1912	do		134,037.00	40,211.10		30.00
1913	do		182,345.90	54,703.77		30.00
1913	Duty remitted (Panama Act).		281.00			
1914[2]	30 per cent		29,707.00	8,912.10		30.00
1914[3]	12 per cent		120,632.00	14,475.84		12.00
1915	do		40,102.00	4,812.24		12.00
1915	Free (for use of the United States).		4,519.00			
1916	12 per cent		40,265.00	4,831.80		12.00
1916[4]	Free (Sec. IV, J. 5).		45.00			
1917	12 per cent		37,302.00	4,476.24		12.00
1918	do		232,430.00	27,891.00		12.00
1918[4]	Free (Sec. IV, J. 5).		9,633.00			
1918[5]	Free (C. R. art. 392).		1,407,005.00			
1919	12 per cent	3,829,706	236,547.00	28,385.64	$0.062	12.00
1919	do	276,732	43,770.00	5,252.40	.158	12.00

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[4] For the construction and equipment of vessels.
[5] For the United States.

Antifriction balls and bearings—Imports for consumption—Revenue.

	Rate of duty.	Value.	Duties collected.	Actual and computed ad valorem rate.
	Per cent.			*Per cent.*
Aug. 6, 1909–Oct. 3, 1913, under act of 1909	45	$6,398,767	$2,879,445.15	45
Oct. 4, 1913–June 30, 1917, under act of 1913:				
Ball bearings	35	5,602,886	1,961,009.05	[1] 35
Balls	35	170,831	59,790.85	35
Parts	35	36,949	12,932.15	35
Roller bearings	35	10,924	3,823.40	35
Total	35	5,821,590	2,037,555.45	[1] 35

[1] Ball bearings to the amount of $15 entered from Cuba at 28 per cent.

Antifriction balls and bearings—Drawbacks paid on imported antifriction balls and bearings subsequently exported.

	Value.	Drawback paid.		Value.	Drawback paid.
1913	$162.00	$70.79	Exports, 1917, in the following articles—Con.		
1914	2,836.50	1,263.65	Traction engines	$2,582.00	$894.67
1915	2,160.46	962.46	Motor cycles	1,817.00	629.59
1916	3,755.99	1,673.26	Optical instruments	1,119.00	387.73
1917	7,219.27	3,216.17	Electrical machinery	713.00	251.91
1918	23,017.00	8,920.06	All other tools	277.00	95.99
1919	59,057.00	21,907.44	Woodworking machinery	169.00	58.55
1917	188,280.00	66,318.14	Mining machinery	31.00	10.74
Exported, 1917, in the following articles:			Other machinery	1.00	.35
Automobiles	106,447.00	37,955.47	Total	188,280.00	66,318.14
Parts of automobiles	1,024.00	357.49			
Firearms	74,100.00	25,675.65			

Ball bearings—Standard list prices previous to April, 1918.

[From the Federal Bearings Co.]

LIGHT 200 SERIES.

Bearing No.	Bore.		Diameter.		Width.		Balls.	
	Millimeters.	Inches.	Millimeters.	Inches.	Millimeters.	Inches.	No.	Size.
200	10	0.3937	30	1.1811	9	0.3543	9	
201	12	.4724	32	1.2598	10	.3937	9	
202	15	.5906	35	1.3780	11	.4331	12	
203	17	.6693	40	1.5748	12	.4724	11	
204	20	.7874	47	1.8504	14	.5512	12	
205	25	.9843	52	2.0473	15	.5906	13	
206	30	1.1811	62	2.4410	16	.6299	13	
207	35	1.3780	72	2.8346	17	.6693	13	
208	40	1.5748	80	3.1496	18	.7087	13	
209	45	1.7717	85	3.3465	19	.7480	14	
210	50	1.9685	90	3.5433	20	.7874	15	
211	55	2.1653	100	3.9370	21	.8268	16	
212	60	2.3622	110	4.3307	22	.8661	17	
213	65	2.5591	120	4.7244	23	.9055	17	
214	70	2.7559	125	4.9213	24	.9449	17	
215	75	2.9528	130	5.1181	25	.9843	17	
216	80	3.1496	140	5.5118	26	1.0236	17	
217	85	3.3465	150	5.9055	28	1.1024	16	
218	90	3.5433	160	6.2992	30	1.1811	16	
219	95	3.7402	170	6.6929	32	1.2598	16	
220	100	3.9370	180	7.0866	34	1.3386	16	
221	105	4.1339	190	7.4803	36	1.4173	16	1
222	110	4.3307	200	7.8740	38	1.4961	16	1 1/16
			MEDIUM 300 SERIES.					
300	10	0.3937	35	1.3780	11	0.4331	8	
301	12	.4724	37	1.4567	12	.4724	8	
302	15	.5906	42	1.6535	13	.5118	10	
303	17	.6693	47	1.8504	14	.5512	10	
304	20	.7874	52	2.0473	15	.5906	10	
305	25	.9843	62	2.4410	17	.6693	10	
306	30	1.1811	72	2.8346	19	.7480	11	
307	35	1.3780	80	3.1496	21	.8268	11	
308	40	1.5748	90	3.5433	23	.9055	12	
309	45	1.7717	100	3.9370	25	.9843	11	
310	50	1.9685	110	4.3307	27	1.0630	11	
311	55	2.1653	120	4.7244	29	1.1417	11	
312	60	2.3622	130	5.1181	31	1.2205	11	
313	65	2.5591	140	5.5118	33	1.2992	12	
314	70	2.7559	150	5.9055	35	1.3780	12	
315	75	2.9528	160	6.2992	37	1.4567	13	1
316	80	3.1496	170	6.6929	39	1.5354	13	1 1/16
317	85	3.3465	180	7.0866	41	1.6142	13	1 1/8
318	90	3.5433	190	7.4803	43	1.6929	13	1 3/16
319	95	3.7402	200	7.8740	45	1.7717	13	1 1/4
320	100	3.9370	215	8.4646	47	1.8504	12	1 5/16
321	105	4.1339	225	8.8583	49	1.9291	12	1 3/8
322	110	4.3307	240	9.4488	50	1.9685	12	1 7/16
			HEAVY 400 SERIES.					
403	17	0.6693	62	2.4410	17	0.6693	8	
404	20	.7874	72	2.8346	19	.7480	8	
405	25	.9842	80	3.1496	21	.8268	8	
406	30	1.1811	90	3.5433	23	.9055	9	
407	35	1.3779	100	3.9370	25	.9842	9	
408	40	1.5748	110	4.3307	27	1.0630	9	
409	45	1.7716	120	4.7244	29	1.1417	10	
410	50	1.9685	130	5.1181	31	1.2205	10	
411	55	2.1653	140	5.5118	33	1.2992	10	1
412	60	2.3622	150	5.9055	35	1.3779	10	1 1/16
413	65	2.5590	160	6.2992	37	1.4567	10	1 1/8
414	70	2.7559	180	7.0866	42	1.6535	10	1 3/16
415	75	2.9528	190	7.4803	45	1.7717	10	1 1/4
416	80	3.1496	200	7.8740	48	1.8897	10	1 5/16
417	85	3.3465	210	8.2677	52	2.0472	10	1 3/8
418	90	3.5433	225	8.8582	54	2.1260	10	1 7/16
419	95	3.7402	250	9.8425	55	2.1654	10	1 1/2
420	100	3.9370	265	10.4330	60	2.3622	10	1 9/16

Ball bearings—Standard list prices previous to April, 1918—Continued.

LIGHT 200 SERIES.

Bearing No.	Bore.		Diameter.		Width.		Balls.		Price each.
	Millimeters.	Inches.	Millimeters.	Inches.	Millimeters.	Inches.	No.	Size.	
	10	0.3937	30	1.1811	9	0.3543	9	7/32	$3.60
	12	.4724	32	1.2598	10	.3937	9	7/32	3.75
	15	.5906	35	1.3780	11	.4331	11	7/32	4.00
	17	.6693	40	1.5748	12	.4724	11	1/4	4.50
	20	.7874	47	1.8504	14	.5512	12	1/4	5.40
	25	.9843	52	2.0473	15	.5906	13	1/4	6.50
	30	1.1811	62	2.4410	16	.6299	13	7/32	7.75
	35	1.3780	72	2.8346	17	.6693	13	1/4	9.50
	40	1.5748	80	3.1496	18	.7087	13	1/4	11.25
	45	1.7717	85	3.3465	19	.7480	14	1/4	12.25
	50	1.9685	90	3.5433	20	.7874	15	1/4	14.00
	55	2.1653	100	3.9370	21	.8268	16	1/4	16.00
	60	2.3622	110	4.3307	22	.8661	16	1/4	19.50
	65	2.5591	120	4.7244	23	.9055	16	7/32	25.00
	70	2.7559	125	4.9213	24	.9449	16	7/32	27.00
	75	2.9528	130	5.1181	25	.9843	16	1/4	30.00
	80	3.1496	140	5.5118	26	1.0236	17	1/4	34.00
	85	3.3465	150	5.9055	28	1.1024	16	5/16	39.00
	90	3.5433	160	6.2992	30	1.1811	16	5/16	48.00
	95	3.7402	170	6.6929	32	1.2598	16	5/16	55.00
	100	3.9370	180	7.0866	34	1.3386	16	5/16	62.00
	105	4.1339	190	7.4803	36	1.4173	16	1	72.00
	110	4.3307	200	7.8740	38	1.4961	16	1 1/16	82.00

MEDIUM 300 SERIES.

	10	0.3937	35	1.3780	11	0.4331	8	7/32	$4.10
	12	.4724	37	1.4567	12	.4724	8	7/32	4.75
	15	.5906	42	1.6535	13	.5118	9	7/32	5.25
	17	.6693	47	1.8504	14	.5512	9	7/32	6.00
	20	.7874	52	2.0473	15	.5906	9	1/4	7.00
	25	.9843	62	2.4410	17	.6693	10	1/4	8.25
	30	1.1811	72	2.8346	19	.7480	11	1/4	10.50
	35	1.3780	80	3.1496	21	.8268	11	5/16	12.50
	40	1.5748	90	3.5433	23	.9055	11	5/16	15.00
	45	1.7717	100	3.9370	25	.9843	11	5/16	18.00
	50	1.9685	110	4.3307	27	1.0630	11	1/4	21.00
	55	2.1653	120	4.7244	29	1.1417	11	1/4	26.50
	60	2.3622	130	5.1181	31	1.2205	11	1/4	32.00
	65	2.5591	140	5.5118	33	1.2992	12	1/4	39.00
	70	2.7559	150	5.9055	35	1.3780	12	1/4	46.00
	75	2.9528	160	6.2992	37	1.4567	13	1	54.00
	80	3.1496	170	6.6929	39	1.5354	13	1 1/16	65.00
	85	3.3465	180	7.0866	41	1.6142	13	1 1/8	78.00
	90	3.5433	190	7.4803	43	1.6929	13	1 3/16	92.00
	95	3.7402	200	7.8740	45	1.7717	13	1 1/4	105.00
	100	3.9370	215	8.4646	47	1.8504	12	1 3/8	120.00
	105	4.1339	225	8.8583	49	1.9291	12	1 7/16	135.00
	110	4.3307	240	9.4488	50	1.9685	12	1 1/2	160.00

HEAVY 400 SERIES.

	17	0.6693	62	2.4410	17	0.6693	8	1 1/4	$10.00
	20	.7874	72	2.8346	19	.7480	8	1 1/4	11.50
	25	.9842	80	3.1496	21	.8268	8	1 1/4	13.00
	30	1.1811	90	3.5433	23	.9055	9	1 1/4	16.00
	35	1.3779	100	3.9370	25	.9842	9	1 1/4	19.00
	40	1.5748	110	4.3307	27	1.0630	9	1 1/4	22.00
	45	1.7716	120	4.7244	29	1.1417	10	1 1/4	27.00
	50	1.9685	130	5.1181	31	1.2205	10	1 1/4	33.00
	55	2.1653	140	5.5118	33	1.2992	10	1 1/4	39.00
	60	2.3622	150	5.9055	35	1.3779	10	1 7/16	47.00
	65	2.5590	160	6.2992	37	1.4567	10	1 1/2	60.00
	70	2.7559	180	7.0866	42	1.6535	10	1 1/2	80.00
	75	2.9528	190	7.4803	45	1.7717	10	1 1/2	95.00
	80	3.1496	200	7.8740	48	1.8897	10	1 7/16	110.00
	85	3.3465	210	8.2677	52	2.0472	10	1 1/4	130.00
	90	3.5433	225	8.8582	54	2.1260	10	1 1/4	150.00
	95	3.7402	250	9.8425	55	2.1654	10	1 1/4	200.00
	100	3.9370	265	10.4330	60	2.3622	10	1 1/4	250.00

Antifriction balls and bearings—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty specific and ad valorem.
Year.	Par.		
1883	167	Forgings of iron and steel, or forged iron, of whatever shape, or in whatever stage of manufacture, not specially enumerated or provided for in this act.	2½ cents per pound.
	216	Manufactures, articles or wares, not specially enumerated or provided for * * * composed wholly or in part of iron, steel, * * * or any other metal and whether wholly or partly manufactured.	45 per cent.
1890	139	Forgings of iron or steel, or forged iron and steel combined, of whatever shape, or in whatever stage of manufacture, not specially provided for in this act,	2⅔ cents per pound. Not less than 45 per cent ad valorem.
	215	Same as 1883	45 per cent.
1894	115	Forgings of iron, or steel or forged iron or steel combined, of whatever shape, or in whatever stage of manufacture, not specially provided for in this act.	1½ cents per pound. Not less than 35 per cent ad valorem.
	177	Manufactured articles or wares, not specially provided for * * * composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent.
1897	127	* * *; antifriction ball forgings of iron or steel, or of combined iron and steel.	45 per cent.
	193	Articles or wares not specially provided for * * * composed wholly or in part of iron, steel * * * or other metal, and whether partly or wholly manufactured.	Do.
1909	123	* * *; antifriction balls, ball bearings, and roller bearings, of iron or steel or other metal, finished or unfinished,	Do.
1913	106	* * *; antifriction balls, ball bearings, and roller bearings, of iron or steel or other metal, finished or unfinished, and parts thereof.	35 per cent ad valorem.

Court and Treasury Decisions.

Raceways for ball bearings, consisting of steel rings of two sizes, invoiced as inner and outer rings, respectively, the diameter of the inner being about $\frac{5}{8}$ inch, and of the outer $1\frac{3}{16}$ inches, with grooves cut on the outer periphery of the inner rings and on the inside of the outer rings, and requiring further grinding and finishing for use as such, were held to fall within paragraph 106 of the act of 1913 and not to be dutiable as manufactures of metal under paragraph 167. (Norma Co. *v.* U. S., 6 Ct. Cust. Appls., 13.)

Small tubes of chromium steel, finished as tubes but to be used as material for the manufacture of other articles, such as ball races for ball bearings rather than as tubes, were held dutiable under the provision for "all other iron or steel tubes, finished, not specially provided for in this section" in paragraph 127 of the act of 1913, and not under the provision for "all steels by whatever process made, containing alloys * * * such as * * * chromium" in paragraph 110. Whether or not an article is a "tube" within the meaning of paragraph 127 was declared to depend wholly upon its form and not upon the use to which it is applied or the method of manufacture. (Ball *v.* U. S., 8 Ct. Cust. Appls. —; T. D. 37271.)

Aligning seats were held dutiable as parts of ball bearings under paragraph 106 of the act of 1913. Abstract 37073 (T. D. 35000).

Completed bearings used in connection with shaft hangers were held properly classified as ball bearings under paragraph 106 of the act of 1913 and not dutiable as manufactures of metal. Abstract 37727.

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UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 108 AND 109 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

RAILWAY FISHPLATES AND STEEL RAILS

Paragraph 108:
Railway Fishplates and Splice Bars

Paragraph 109:
Sheets and Plates (See Par. 105)

Paragraph 587:
Rails

REVISED EDITION

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PREFACE.

This is one of a series of tariff information surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this act at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.

2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.

3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and Index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of Abraham Berglund and L. A. Rufener, of the Metals Division of the Commission's staff, and of others.

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RAILWAY FISHPLATES OR SPLICE BARS.

SUMMARY.

e census of manufactures of 1914 reported 26 establishments ıcing rail fastenings (including splice bars, tie-plates, fishplates, with a total production of 349,307 tons, valued at $11,526,956. eading States in 1909 were Illinois, Pennsylvania, New York, and . The Annual Statistical Report of the American Iron and Steel tute reports production of rail joints and fastenings, not includ- olts and nuts, as 627,478 tons in 1913 and 361,624 tons in 1918. ırts have been small. During the period 1907–1918 they ex- d $17,000 in value in only one year, 1914, when they were d at $18,672. Exports have been large, reaching their maxi- value, $9,108,617, in 1917. The six leading countries to which ts went in 1918 were France, Cuba, Canada, Russia, Japan, and)utch East Indies.

the act of 1909 fishplates or splice bars were dutiable at three- s of 1 cent per pound, a duty which was equivalent during the years 1911–1913 to an ad valorem rate of approximately 19 per The act of 1913 substituted for that specific duty an ad va- ı duty of 10 per cent.

Railway fishplates or splice bars—Summary table.

ear.	Domestic production (calendar year).[1]	Imports for consumption (fiscal year).[2]	Domestic exports (fiscal year).[3]	Ratio to production (per cent). Imports.[4]	Value (imports for consumption).	Amount of duty.	Value per unit of quantity (pound).	Equivalent ad valorem rate.
	Long tons.	*Long tons.*						*Per cent.*
.....	.....	384.45	.....	.....	$13,471.00	$2,859.54	$0.016	21.23
.....	.....	489.76	.....	.....	16,508.00	3,291.14	.015	19.94
.....	527,771	301.57	.....	0.058	10,949.00	2,046.74	.016	18.69
.....	627,478	448.96	$2,806,242.00	.072	16,445.00	3,017.06	.016	18.34
.....	362,726	475.92	2,534,148.00	.131	18,672.00	2,135.55	.018	11.44
.....	470,724	275.43	2,407,490.00	.059	7,486.00	748.60	.012	10.00
.....	602,109	589.78	5,261,944.00	.098	16,106.00	1,610.60	.012	10.00
.....	529,403	350.56	9,108,617.00	.066	13,116.00	1,311.60	017	10.00
.....	361,624	73.17	6,286,369.00	.020	3,424.00	342.40	.021	10.00
.....	378,083	336.44	9,477,533.00	.078	26,638.00	2,663.80	.035	10.00
.....	.....	429.96	5,789,862.00	.....	24,276.00	2,427.60	.025	10.00

luction statistics are from Annual Statistical Report of the American Iron and Steel Institute, and angle splice bars, tie-plates, fishplates, and other rail joints. (For details see p. 10.)
way fishplates or splice bars.
way track material such as switches, frogs, splice bars, fishplates, etc., not including rails and Quantity not specified.
entages show relation between quantity of fishplates or splice bars imported and quantity of angle ars, tie-plates, fishplates, and other rail joints produced in the United States.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT 1913.

3. Railway fishplates or splice bars made of iron or steel, 10 per ad valorem.

DESCRIPTION.

hplates or splice bars are iron or steel plates fitted to the web of ad rails, and sometimes partly embracing the foot. They are in pairs, one on each side of the junction of two rails, to join them

end to end, and are fastened together by bolts passing through t rails. When in position they form a fish joint and assist in suppo ing the ends of the rails as the train passes from one to another.

DOMESTIC PRODUCTION.

Material.—Splice bars are made of iron or steel bars, usually steel bars. The standard specifications adopted by the Amer Society for Testing Materials, as published by the Department Commerce in its Industrial Standards Series (Nos. 4, 5, 6, 30, and 3 specify the chemical composition of the steel used in the manufact of splice bars as to carbon, phosphorus, or manganese content. these specifications low-carbon steel splice bars may be made fr steel produced by any process approved by the purchaser. B splice bars of medium-carbon, high-carbon, extra high-carbon, a quenched high-carbon steel must be made of steel produced by t open-hearth process.

Organization.—Under the head of rail fastenings (including spl bars, tie-plates, fishplates, etc.), the census of manufactures report 26 establishments in 1914, with a total production of 349,307 to valued at $11,526,956, and 25 establishments in 1909 with a tot output of 396,911 tons, valued at $14,488,412.

The Annual Statistical Report of the American Iron and Steel Ins tute for 1918 reports the quantity of rail joints and fastenings pr duced by rolling mills and steelworks in 1914 at 362,726 gross to (a figure somewhat higher than that given by the census for the sam year); in 1913, 627,478 tons; and in 1915, 470,724 tons. Productio in 1914, therefore, appears to have been abnormally low. In th A B C of Iron and Steel, published in 1917, 29 splice-bar manufac turers are listed. These include the Bethlehem Steel Co., Cambri Steel Co., Carnegie Steel Co., Lackawanna Steel Co., and other larg iron and steel producers, showing that splice bars are largely pro duced as a minor product by large iron and steel manufacturers.

Geographical distribution.—In 1909, according to the census, 145,027 tons of rail fastenings were produced in Illinois, 124,049 tons in Pennsylvania, 51,827 tons in New York, 27,381 tons in Ohio, and 48,627 tons in all other States. In 1914, 24,365 tons were pro duced in Ohio, 108,235 tons in Pennsylvania, 2,848 tons in Wisco sin, and 213,859 tons in all other States.

The Annual Statistical Report for 1912 of the American Iron an Steel Institute reported 26 active works producing rail fastening (except bolts, nuts, etc.) in 1912. Of these, 11 were in Pennsyl vania and the others scattered in New York, Virginia, Alabama, Ohio, Indiana, Illinois, Wisconsin, Colorado, and California. Tha report states the production of New York, Pennsylvania, and Vir ginia to have been 283,583 tons; of Alabama, Ohio, and Indiana, 69,504 tons; and of Illinois, Wisconsin, Colorado, and California, 149,714, making a total for all States in 1912 of 527,771 tons.

Domestic production and consumption.—Domestic production ex ceeds domestic consumption. Imports in no year from 1907 to 1918 exceeded $18,672 in value. The value of track material, except rails and spikes, exported in the fiscal year 1914 was $2,534,148, or 21.98 per cent of the total value of rail fastenings produced in the United States in that year. It is impossible to state what propor tion of this track material consisted of fishplates or splice bars.

Domestic exports.—Exports of railway-track material such as switches, frogs, fishplates, splice bars, etc. (except rails and spikes) amounted in 1913, the first year for which statistics are available, to $2,806,242. In 1914 and 1915 exports decreased somewhat in value, but in 1916 they rose to $5,261,944 and in 1917 to $9,108,617. In 1918 they fell below the 1917 figure, but were still at the high figure of $6,286,369. The large increase in the value of exports was probably due to increase in unit value and increased demand because of the war.

On pages 11 and 12 are shown exports to all countries to each of which the value exported amounted to $100,000 in any year from 1913 to 1918. There are 18 countries in that list, showing that the exports were not only large, but were widespread in the markets of the world. In 1913 the six leading countries, in order, were Canada, Brazil, Mexico, Australia, Cuba, and England, and the exports to those countries ranged in value from $732,617 to Canada down to $101,081 to England. In 1918 the six leading countries were France, Cuba, Canada, Russia in Europe, Japan, and the Dutch East Indies.

FOREIGN PRODUCTION.

Foreign production statistics are not available. The heaviest producers of splice bars are, however, naturally the countries leading in the production of iron and steel rails. These are, in addition to the United States, Germany, England, and France, and of less importance Russia, Canada, and Belgium.

IMPORTS.

Imports in recent years have been unimportant. The greatest quantity imported in any year since 1907 was in 1916, when the amount was 1,321,110 pounds, or 590 tons. The value of imports was greatest in 1914, amounting to $18,672.

TARIFF HISTORY.

The acts of 1883 and 1890 imposed specific duties, 1¼ and 1 cent, respectively, upon railway fishplates or splice bars made of iron or steel, and the act of 1894 imposed an ad valorem duty of 25 per cent. The act of 1897 substituted a specific duty of four-tenths of 1 cent per pound. This duty was reduced to three-tenths of 1 cent per pound by the act of 1909. In 1913 an ad valorem duty of 10 per cent was imposed.

Imports fluctuated considerably during the period from 1907 to 1918, but have never been large compared with domestic production, and the reduction in the rate of duty in 1909, although followed by an increase in imports, can hardly have had a perceptible effect on American industry. The maximum imports under the act of 1909 were 1,097,055 pounds, or 490 tons, in 1911—less than one-sixth of 1 per cent of domestic production as stated by the census in either 1909 or 1914. If import statistics are compared with the production statistics supplied by the American Iron and Steel Institute the percentage is even smaller.

The average equivalent ad valorem rate of the duty of three-tenths cent per pound imposed during the years 1911-1913 was approximately 19 per cent. The substitution of a duty of 10 per cent ad

valorem by the act of 1913 represented, therefore, a substs reduction. In 1916 the quantity of imports was nearly a greater than in 1913, the last year under the old law, but in 1915, and 1918 imports were considerably below the 1913 level.

Competitive conditions.—Railway fishplates or splice bars simple manufactures of iron or steel, in which raw material repre an important part in cost of production. As such they belong category of articles well suited to production under American ditions. The large exports since 1913 and the small imports u the various duties (10 per cent to 35 per cent) indicate that A can producers have occupied for some years and now hold a st position in international competition. Our large domestic m and established export trade give our manufacturers of splice better opportunities for mass production and its attendant e mies than foreign producers enjoy.

Rail fastenings (splice bars, tie-plates, fishplates, etc.)—Production in United St

[From Federal census.]

State.	1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	V
	Long tons.		*Long tons.*		*Long tons.*	
Illinois			145,027	$5,158,902		
New York			51,827	1,923,808		
Ohio			27,381	915,410	24,365	
Pennsylvania			124,049	4,669,802	108,235	3,
Wisconsin					2,848	
All other			48,627	1,820,490	213,859	6,
Total	174,055	$5,663,052	396,911	14,488,412	349,307	11,

Angle splice bars.—Production in United States (gross tons).

[From annual statistical report of the American Iron and Steel Institute.]

1912	183,279	1916	
1913	133,450	1917	
1914	86,775	1918	
1915	119,658	1919	

Tie-plates.—Production in United States (gross tons).

[From annual statistical report of the American Iron and Steel Institute.]

1912	261,541	1916	
1913	324,428	1917	
1914	205,385	1918	
1915	283,509	1919	

Fishplates.—Production in United States (gross tons).

[From annual statistical report of the American Iron and Steel Institute.]

1912	19,146	1916	
1913	16,559	1917	
1914	11,664	1918	
1915	10,836	1919	

Other rail joints.[1]*—Production in United States (gross tons).*

[From annual statistical report of the American Iron and Steel Institute.]

1912	63,805	1916	
1913	133,041	1917	
1914	58,902	1918	
1915	56,721	1919	

[1] Other than those specified in above tables.

ints and fastenings produced by rolling mills and steel works.[1]*—Production in United States (gross tons).*

[From annual statistical report of the American Iron and Steel Institute.]

.....	527,771	1916.....	602,109
.....	627,478	1917.....	529,403
.....	362,726	1918.....	361,624
.....	470,724	1919.....	378,083

esents the total of the four items specified in the four preceding tables. Does not include spikes, ts, and similar fastenings.

Rail joints and fastenings—Production in United States—States, 1912.

[From annual statistical report of the American Iron and Steel Institute, 1912.]

	Long tons.
rk, Pennsylvania, and Virginia.....	283,583
, Ohio, and Indiana.....	69,504
Wisconsin, Colorado, and California.....	149,714

y fishplates, or splice bars of iron and steel—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$\frac{4}{10}$ cent per pound.	764,098	$11,938.00	$3,056.40	$0.016	25.72
.....	.....do.....	395,158	6,379.72	1,580.62	.016	24.77
.....	.....do.....	96,698	2,095.75	386.79	.022	18.46
.....	.....do.....	276,038	3,192.00	1,104.15	.012	34.60
.....	$\frac{4}{10}$ cent per pound.	585,129	10,279.00	1,755.39	.018	17.08
.....	.....do.....	1,097,055	16,508.25	3,291.14	.015	19.94
.....	.....do.....	682,243	10,948.50	2,046.74	.016	18.69
.....	.....do.....	1,005,679	16,445.00	3,017.06	.016	18.34
.....	.....do.....	175,683	2,587.00	527.05	.015	20.37
.....	10 per cent ad valorem.....	890,371	16,085.00	1,608.50	.018	10.00
.....	.....do.....	616,973	7,486.00	748.60	.012	10.00
.....	.....do.....	1,321,110	16,106.00	1,610.60	.012	10.00
.....	.....do.....	785,274	13,116.00	1,311.60	.017	10.00
.....	.....do.....	163,892	3,424.00	342.40	.021	10.00
.....	.....do.....	753,622	26,638.00	2,663.80	.035	10.00
.....	.....do.....	963,102	24,276.00	2,427,60	.025	10.00

1 to Aug. 5, 1909, under act of 1897.
6, 1909, to June 30, 1910, under act of 1909.
3 July 1 to Oct. 3, 1913, under act of 1909.
4 Oct. 4, 1913, to June 30, 1914, under act of 1913.

y track material, such as switches, frogs, fishplates, splice bars, etc., (except rails and spikes)—Domestic exports (fiscal years).

Exported to[1]—	1913[3]	1914	1915	1916	1917	1918
.....	$1,941	$5,869	$800,990	$636,253	$3,320,310	$1,680,377
.....	.....	.....	22,102	302,865	72,114	.....
.....	.....	.....	1,262	51,569	132,532	28,745
n Europe.....	689	83,626	139,225	1,100,982	1,240,160	437,246
.....	101,081	39,884	39,819	44,787	69,146	73,901
.....	732,617	793,134	260,981	348,554	893,998	761,984
.....	354,579	95,543	44,336	98,229	47,971	202,391
.....	204,881	218,670	172,132	645,795	1,007,261	916,702
an Republic.....	30,199	11,070	13,177	37,378	36,339	120,794
a.....	72,886	124,688	22,008	44,153	12,670	25,434
.....	388,143	339,560	105,097	159,762	208,225	87,500
.....	55,747	83,939	181,814	44,884	223,666	214,925
.....	61,748	51,488	39,713	58,878	121,933	70,103
.....	49,968	10,600	38,115	23,510	10,937	170,932
ast Indies.....	2,367	.....	7,112	45,140	69,874	402,151
.....	75,160	83,588	32,498	26,691	129,120	408,576
n Asia.....	.....	.....	.....	1,040,657	882,356	50,617
.....	206,383	45,685	178,044	67,577	11,437	27,383
tal.....	2,806,242	2,534,148	2,407,490	5,261,944	9,108,617	6,286,369

rts are shown to all countries to which exports amounted to $100,000 in any year 1913–1918.
ded in "all other manufactures" of iron and steel prior to 1913.
dition to exports shown for China, small exports to the value of $110,027 went to Chinese territory
Japan in 1918 and a few thousand dollars' worth in earlier years.

Railway fishplates or splice bars—Domestic exports (calendar years).

Exported to—	1918	1919	Exported to—	1918	1919
Belgium		$332,422	China [1]	$78,180	$70,072
France	$2,067,394	3,053,841	Dutch East Indies	121,893	427,132
Italy	131,917	463,078	Japan	462,331	926,462
England	18,598	44,326	Russia (Asia)	8,786	62,423
Canada	765,541	345,755	Australia	34,209	33,047
Mexico	111,219	233,180	Philippines	124,098	150,267
Cuba	678,199	743,303	British South Africa	87,708	758,704
Argentina	12,131	14,797	All other	593,617	706,304
Brazil	38,907	561,313			
Chile	170,300	171,136	Total	5,582,860	9,280,725
Peru	77,832	172,851			

[1] Exports to Kwantung (leased territory) were $157,115 in 1918, $222,034 in 1919.

Court and Treasury Decisions.

The articles dutiable under paragraph 108 of the act of 1913 and the articles removed from duty in paragraph 587 are of the same class, for rails and splice bars are made of old heavy rails as raw material.

See survey on rails.

Old fishplates so worn as to be wholly useless for rail or track purposes and fit only for remanufacture were held dutiable under the provision for scrap steel in paragraph 122 of the act of 1897 and not as railway fishplates under paragraph 130. (Ginsburg *v.* United States, 147 Fed., 531.)

Railway fishplates or splice bars—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	160	Iron or steel railway fishplates or splice bars	1½ cents per pound.
1890	181	Railway fishplates or splice bars made of iron or steel	1 cent per pound.
1894	152	.....do	25 per cent ad valorem.
1897	130	* * * railway fishplates or splice bars made of iron or steel	⅘ cent per pound.
1909	126	.....do	⅘ cent per pound.
1913	108	Railway fishplates or splice bars made of iron or steel	10 per cent ad valorem.

RAILS.

SUMMARY.

DESCRIPTION.

s are rolled shapes, now usually made of steel, used for guiding rrying the wheels of railroad cars. They are divided into and light, the dividing line being determined by the weight ear yard. This line is variously fixed at 40, 45, or 50 pounds rd. Heavy rails, which are the ones figuring principally in tional trade, are the rails used by the steam railroads of the and to a large extent by electric roads. Light rails, now manufactured out of old heavy rails, are used for private by mining and other industrial companies. The high tee and ails, which constitute a third class, are used for street railways.

DOMESTIC PRODUCTION.

production of rails in the United States during the years 1910 9, inclusive, averaged 2,800,000 gross tons per annum, of approximately 90 per cent consisted of heavy rails. Varia- output from year to year is considerable. During the period noted the maximum annual production was 3,636,031 ons in 1910 and the minimum 1,945,095 gross tons in 1914. nner year for rail production in this country was 1906, when tput was 3,977,887 gross tons. Variation in output is closely to the amount of railroad building going on and the degree perity enjoyed by the country.

ods and processes.—Rails are rolled from heated ingots by l compression, reduction, and consequent elongation to the and sizes desired, in large mills built for that purpose. While ine-made article, great care has to be exercised in order to n to exact specifications. There is a much larger gross loss ht in rolling than in the case of billets or sheet bars on account extensive cropping of the ends made necessary in order to lefects in the steel, due to premature cooling. There is con- le labor involved in straightening and finishing the rail after ol.

rials.—The raw material of heavy steel rails is the steel ingot. el ingot and the pig iron out of which it is made are domestic ts, as are also the ore, coke, and limestone used in their manu- . The raw material of light rails is largely old heavy rails. at 80 per cent of the country's production is made of open- steel, a matter worthy of note in view of the fact that the er rail is the principal product of other rail-producing coun- In the manufacture of open-hearth steel ferromanganese plays ortant part, and this product is derived from manganese ore, ater part of which is imported. The home production of this reased to something like 25 to 35 per cent of the country's in 1918 but rapidly declined after the armistice.

Organization and integration.—The manufacture of steel rails, which necessitates a heavy outlay of capital, has become a highly concentrated industry. In the United States a small number of companies produce the bulk of the output, the United States Steel Corporation itself producing over half the country's tonnage. There has been a marked tendency for rail-producing concerns in the United States to secure control of the anterior stages of production from the mining of ore and coal to the manufacture of the rail.

Localities of production.—The principal manufacturing establishments are located in the northeastern part of the United States—in the region from Chicago to eastern Pennsylvania—and in the Birmingham district of Alabama. This localization is owing to the fact that it is in these regions that iron and steel manufactures have attained their greatest development, due to the proximity or easy reach of large ore, coal, and limestone deposits.

The demand for rails has tended to move westward on account of the need for greater and better transportation facilities in the Middle West and on the Pacific coast. It was partly to satisfy this demand that the town of Gary, Ind., was built by the United States Steel Corporation.

Domestic production, consumption, and exportation.—The production of steel rails in the United States has for many years been greater than the consumption. Hence there has been a surplus for export. Exports during the fiscal years 1916 and 1917 aggregated over 1,100,000 gross tons, or nearly 20 per cent of the domestic production. During the 10 years 1910–1919 they constituted about 15 per cent of the domestic production. Our exports of steel rails have gone mainly to Canada, Latin America, Australia, and Japan. After the outbreak of the war exports to Europe increased. During the fiscal year 1916 Russia (European and Asiatic) took over half the total amount exported. Exports in 1919 aggregated 620,000 gross tons, the principal countries of destination being Japan, France, and Cuba.

History.—Before the Civil War only iron rails were produced in commercial quantities, and these not in large amounts. Steel rails were first produced in appreciable quantities in 1867. The high import duties imposed upon iron and steel products in general, the introduction of the Bessemer process for manufacturing steel, the great demand for improved transportation facilities in the rapidly growing West, and the great resources of the country in ore and coal all gave an impetus to the manufacture of steel rails. Steel rails were largely supplanting iron rails in the seventies, and since 1882 the production of iron rails has been relatively small. The introduction of the open-hearth process is resulting in the substitution of open-hearth rails for the Bessemer product. Since 1910 the United States has produced more open-hearth rails than Bessemer rails.

FOREIGN PRODUCTION.

Before 1914 Germany was the greatest producer of steel rails in Europe. The annual output was something over 1,000,000 metric tons, or less than one-half that of the United States. Great Britain produced a little less than 1,000,000 tons. In Russia, France, Belgium, Canada, Austria-Hungary, and Italy the output of rails was considerable. The rails which these countries produced and exported were in the main heavy rails manufactured out of steel produced by the Bessemer process.

IMPORTS.

With the exception of the years 1914, 1915, and 1916, imports of rails have been for a long time considerably less than 1 per cent of the total production in the United States. During the fiscal years 1915 and 1916 the amount and proportion imported showed a material increase, though this increased importation was small compared with the total production. In 1917 there was a decided falling off in the amount and value of imports of rails.

Before the outbreak of the war in Europe, Germany and Canada supplied us with most of the imported product, but since the beginning of that struggle Canada has been almost the sole source of our imports.

Rails being a commodity of which the cost of transportation forms an important element in price, are affected very materially in their movement by freight rates. On account of the high rail rates, the imported product does not seriously compete with domestic rails in the interior but does so to a limited extent on the coasts and in the Great Lakes region. Before the war the cost of transporting rails from the leading centers of production in the United States to the Pacific coast was materially greater than the cost of shipping them from the mills of England and Germany to the same region. The enormous increase in ocean freights since the beginning of the war has for the present changed that situation.

PRICES AND COSTS.

The mill prices of rails in this and other rail-producing countries do not differ very greatly. In other countries fluctuations in quotations have been greater than in the United States, where rail prices have been stable for long periods. From April, 1901, to May, 1916, the quotations for heavy, standard-section steel rails in the United States remained at $28 per gross ton, although premiums, especially in late years, have been paid for prompt delivery. In 1918 quotations were: Bessemer, $55: open-hearth, $57; in April, 1921, Bessemer, $45; open-hearth, $47.

Export prices in rail-producing countries are generally lower than domestic prices. Commerce in steel rails is encouraged in some countries by indirect bounties. In Germany, before the war, transportation rates to seaports were lower on export goods than on goods destined for home consumption. The same has been true of the United States until recently (1918).[1] In Germany ore associations and coal and pig-iron producers sold their material at lower prices when such material entered into the manufacture of export rails than when it entered into the production of rails to be used at home.

Evidence shows that costs of production vary greatly in different parts of this and other countries. This variation is more noticeable in the anterior stages of production—in the mining of ore and coal and in the manufacture of pig iron than in the production of rails from steel ingots. Evidence tending to show that rails are produced more cheaply in Europe than in the United States is not conclusive.

[1] Interstate Commerce Commission.

TARIFF HISTORY.

Paragraph 587 of the tariff of 1913 provides for the free admissio of "railway bars made of iron or steel and railway bars made in pa of steel, T rails, and punched iron or steel rails."

In 1870, when steel-rail production in the United States was i its infancy, steel railway bars were specifically provided for at 1 cents per pound ($28 per gross ton), and those in part of steel at 1 ce per pound ($22.40 per gross ton). These duties were reduced 1 per cent in 1872, but were restored three years later. In 1883 th duty was changed to $17 per gross ton on railway bars, whethe made wholly or in part of steel, when weighing more than 25 pound to the yard. On iron railway bars weighing more than 25 pound to the yard a duty of seven-tenths cent ($15.68 per gross ton) wa imposed. Specific provision was also made in the act of that yea for iron or steel tee (sic) rails, weighing not over 25 pounds to th yard, with a duty of nine-tenths cent per pound ($20.16 per gros ton), and for iron or steel flat rails, punched, at eight-tenths cent per pound ($17.92 per gross ton). At times during this period these tariffs were equivalent to an ad valorem duty of 60 per cent or more. In the act of 1890, and later acts, these manufactures of iron and steel were combined in one paragraph and the adjective "tee" before "rails" was changed to the letter "T." The rate of duty, which was fixed at six-tenths cent per pound ($13.44 per gross ton) in 1890 was further reduced to seven-twentieth cent per pound ($7.84 per gross ton) in the acts of 1894 and 1897 and to seven-fortieth cent per pound ($3.92 per gross ton) in 1909.

The reductions prior to 1913 apparently exercised no very permanent effect upon importation. After the passage of the act of 1913, however, placing rails upon the free list, importations for consumption which had been running from 3,800 to 5,000 tons per annum in the three preceding years rose to 55,000 tons in the fiscal years 1915 and 1916. The importation was almost entirely across the Lakes from Canada.

High protective duties are imposed on rail imports in France, Germany, and Italy. Canada, which has in recent years supplied the United States with the bulk of its rail imports, itself has a general rate of $7 per ton on "iron and steel railway bars or rails," with an intermediate rate of $6 per ton and the British preferential rate of $4.50 per ton.

TARIFF QUESTIONS INVOLVED.

The United States leads the world in the production of steel rails and is practically self-sufficient with regard to most materials entering into their manufacture. This branch of manufacture is to-day maintaining itself without any tariff protection. The large export trade of the United States, a trade which antedated the present war, indicates the competitive strength of the American industry even in foreign markets.

The manufacture of light rails out of old heavy rails presents a problem in the matter of tariff classification. Light rails, like heavy rails, are admitted free under the tariff of 1913. Old heavy rails to a large extent constitute the raw product for splice bars and other railway steel which are protected by moderate duties. The manu-

rers of light rails are thus restricted in their competition for
naterial as against manufacturers of other railroad material.
obvious that some difficulty presents itself in imposing an
:t duty on light rails while heavy rails are still retained on the
ist.

)m a revenue standpoint the importation of rails has not in
t years been important. During the period 1907–1913, when
were still dutiable, the greatest amount of revenue derived by
iovernment in any one year was $30,885 in 1907, when a tariff
.84 per ton was levied. In 1909, under the same tariff, it was
a little over $9,000.

Rails—Summary table.[1]

Year.	Domestic production.	Imports for consumption.	Domestic exports.	Ratio to production.	
				Imports.	Exports.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Per cent.*	*Per cent.*
	3,636,031	[2] 2,488.01	353,180	.....	9.71
	2,822,790	3,834.49	420,874	0.14	14.90
	3,327,915	4,024.95	446,473	0.12	13.42
	3,502,780	4,770.68	460,553	0.14	13.15
	1,945,095	20,301.50	174,680	1.04	8.98
	2,204,203	78,525.00	391,379	3.56	17.76
	2,854,518	26,367.00	540,828	0.92	18.93
	2,944,161	9,263.00	512,669	0.31	17.34
	2,540,892	8,339.00	453,944	0.33	17.87
	2,203,843	17,208.00	621,684	.....	.....

Year.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
			Per gross ton.	*Per cent.*
	[2] $63,117.66	[2] $9,752.97	$25.37	15.45
	99,471.00	15,031.19	25.89	15.11
	108,024.00	15,777.82	26.50	14.61
	115,406.68	[3] 16,890.06	24.19	[4] 16.39
	567,547.00	.....	27.94	[5]
	2,088,532.00	.....	26.60	[5]
	742,923.00	.....	28.18	[5]
	307,139.00	.....	33.16	[5]
	319,476.00	.....	38.31	[5]
	665,844.00	.....	38.69	[5]

'es given in this table are for calendar years.
ıonths. It was not until after June 30, 1910, that figures for imports for consumption were compiled
3ureau of Foreign and Domestic Commerce for quarters. The figures for imports (quantity and
re for the last two quarters of the calendar year 1910.
ınt of duty collected on 4,308.68 tons, valued at $103,048.68, imported during the period Jan. 1–
913.
valent ad valorem duty on 4,308.68 tons valued at $103,048.68.

General Information.

DESCRIPTION.

ils are rolled shapes for guiding and carrying the wheels of rail-
cars. The steel from which rails are rolled is prepared to con-
to standard specifications, the sections of rails in the United
s being made in accordance with the standards of the American

Society of Civil Engineers.[1] The T section rail, invented in 1830, is in universal use on steam railroads in the United States and Canada. In England the so-called bullheaded rail is used.[2] Rails in addition to being sawed square and straightened are drilled at their ends for holes to receive bolts for splicing and joining their ends. The standard length when shipped is 30 to 33 feet, although rails are rolled to 120 feet and more.[1]

Kinds of rails.—Rails are usually divided into light and heavy, the classification being determined by weight per linear yard. The dividing line between these classes is variously fixed at 40, 45, and 50 pounds per yard. Light rails are now largely manufactured out of old heavy rails and are used in mining and other industrial operations. The high T and girder rails, the latter so-called because of their shape, which resembles a girder, may be considered a third class. Their production in the United States forms a small proportion of the country's total—from one to two hundred thousand tons.[3] These rails are used for street railways. Iron rails, which were once manufactured in large amounts, are now produced in negligible quantities in the United States.

The rails which enter into international trade in large amounts are the heavy rails. On the main lines of the principal American railroads the 85 to 90 pound rail is the standard, and on roads of very heavy traffic, like the Pennsylvania, New York Central, and New York, New Haven & Hartford, the 100-pound rail has lately been the standard. In 1914 the Pennsylvania Railroad began the use of the 125-pound rail. Where traffic is light and on branch roads, 65 and 70 pound rails are in use.[2]

Manganese rails are being experimented with for use on curves, as rail wear is there much greater than on straight track. In the French tariff of 1910 manganese rails, i. e., rails containing 9 per cent manganese and over, are subject to higher duties than those of iron or common steel.[4]

With reference to process of manufacture, another division may be made between Bessemer and open-hearth rails, the latter having become more important in the United States in recent years than the former. It is important to recognize this fact, because the great bulk of the heavy rails produced in other countries are made from steel produced by the Bessemer process, either acid or basic, and it is the Bessemer rails which have figured most prominently in international trade.[5]

DOMESTIC PRODUCTION.

Quantity.—The production of steel rails in the United States far exceeds that of any other country in the world. In the years immediately preceding the outbreak of the war in Europe this production was approximately double that of the next most important rail-producing country—Germany. In 1919 the rails produced in the United States amounted to 2,203,843 gross tons. During the years 1910–1917, inclusive, production has varied from 1,945,095 gross tons in 1914 to 3,636,031 gross tons in 1910.

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[1] The A. B. C. of Iron and Steel, p. 166.
[2] International Encyclopedia, vol. 19, p. 493.
[3] Annual Report of the American Iron and Steel Institute, 1916, p. 38.
[4] Bureau of Manufactures, Tariff Series No. 25.
[5] Report of Commissioner of Corporations in the Steel Industry, Pt. III, p. 460.

The greater part of the rails produced in the United States are made of open-hearth steel. In 1919 out of a total output of 2,203,843 gross tons 1,893,250 gross tons consisted of the open-hearth product. This development is comparatively recent. In 1910 more than half the rails manufactured in this country consisted of Bessemer steel. The production of iron rails is negligible.

The output of heavy rails vastly exceeds that of light rails. Of the 1919 total only 263,803 gross tons, or slightly more than one-tenth, were rails less than 50 pounds weight per linear yard and 1,444,463 gross tons were rails weighing 85 pounds or more per linear yard.

Processes of manufacture and industrial integration.—Rails are a rolled product, and the production of rolled forms of iron and steel is accomplished in rolling mills. The operation proceeds by passing heated steel between two or more sets of rolls which compress and reduce the material into desired shapes.

Rails, while primarily a machine-made article, are not a particularly simple product, because they have to be made with great care and according to exact specifications. There is a much larger gross loss in weight in rolling than for billets or sheet bars on account of the extensive cropping of the ends of the material, this cropping being necessary to avoid defects in the steel caused by premature cooling.[1] The labor element entering into the manufacture of steel rails is not inconsiderable. In figuring book costs of production for the United States Steel Corporation for 1910 the Commissioner of Corporations found that the labor element directly engaged in the production of steel rails amounted to from 6 to 9 per cent of the total cost.[2] However, if the value added to the steel ingot in the process of manufacture be taken alone, the labor element constituted about 40 to 50 per cent of the total mill cost of converting the ingot into the steel rail. There is much labor involved in straightening and finishing the rail after it is cool.[2]

Mills manufacturing standard section steel rails require a large investment of capital. Where the anterior stages of production are controlled by the producing company, as is more commonly the case in the United States, the investment will amount to many millions of dollars. On account of the large investment necessary for the proper equipment of such a plant the number of companies engaged in the production of steel rails is small compared with the country's output. One corporation, the United States Steel Corporation, produces between 50 and 60 per cent of the country's output.

Materials used in manufacture.—The raw material for the production of heavy standard steel rails is the steel ingot, either the Bessemer rail ingot or the open-hearth rail ingot. The ingot, and the pig iron out of which the ingot is made, is a domestic product, as are also the ore, coke, and limestone used in their production. The most important steel-rail producers, like the United States Steel Corporation and the Bethlehem Steel Corporation, control their own sources of supply of raw materials.[3]

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[1] Report of Commissioner of Corporations on The Steel Industry, Pt. III, pp. 461–465. The reason for the small percentage is, of course, due to the fact that the cost of the ingot constitutes over 80 per cent of the mill cost of the rail.

[2] Ibid., p. 203.

[3] The Bethlehem Steel Corporation has been relying, especially in late years, upon ore from its Cuban holdings. Owing to the location of some of its plants, it is cheaper to utilize ores from Cuba with low transportation cost by water than to get the ore from the Lake Superior region.

In the case of light rails, old heavy rails are largely utilized, and the sources of supply are the railroads of the country or dealers who secure their stock from the railroads.

With respect to the materials entering into the production of steel rails the United States is self-sufficient. In the manufacture of steel, ferromanganese and spiegeleisen are of great importance. The raw material of these alloys is manganese ore, of which there has been a very limited production in this country. Manganese ore is imported mainly from Brazil, British India, and Cuba. Before the outbreak of war in 1914 Russia furnished this country a considerable part of the supply.[1]

Regions of production, distributing agencies, and principal markets.—The principal manufacturing establishments are located in the east-central region, extending from Chicago to eastern Pennsylvania, and in the Birmingham district of Alabama. The prices of steel rails in the United States are normally fixed by the prices quoted at the Pennsylvania mills, plus cost of transportation to consuming regions.

Rails are made on orders from railroad companies and for the general market. They are usually sold direct to consumers (railroads), but in the export trade they are often handled through dealers or export merchants. The United States Steel Corporation has such an agency in one of its subsidiaries, the United States Steel Products Co., which handles its export trade.

Within the United States the demand for rails has tended to move westward. The reason for this is the increasing need for greater and better transportation facilities in the Middle West and on the Pacific coast on account of increasing population and the rapid industrial growth of those regions. It was partly to satisfy this demand—to have a greater number of mills serving this need—that led the United States Steel Corporation to build the town of Gary, Ind.

Domestic consumption.—For many years the production of steel rails has far exceeded the consumption, leaving a surplus for export. In 1919 (calendar year), with an output of 2,203,843 gross tons, the country imported for consumption 17,208 gross tons and exported 621,684 gross tons. The apparent consumption that year thus amounted to 1,599,367 gross tons. In 1915 (calendar year), when our imports reached the relatively high figure of 78,525 gross tons, our exports were approximately five times as great.

Exports.—During the calendar years 1910 to 1919, inclusive, our rail exports have ranged from 174,680 gross tons in 1914 to 621,684 gross tons in 1919 and constituted from approximately 8 to 28 per cent of the domestic production. Before the war rails exported from the United States went mainly to Canada, Mexico, Cuba, Brazil, Argentina, Japan, and Australia (including Tasmania). After the outbreak of the war the exportation of rails to Russia (both European and Asiatic) increased enormously for a time—1915 to 1917. The exports to Japan and Cuba continue large, but there has been a marked decline in the trade with Mexico and South America.

History.—The first rails produced in the United States were flat and made of iron. The T rail began to be manufactured in this country in 1844, although it had been imported for over a decade, as were also other forms. The rail mills of the country met with much foreign competition, and in 1849 Abram Hewitt wrote that of

[1] See Tariff Commission's Survey on manganese ore.

15 mills in the country only 2 were then in operation, "doing partial work for limited orders of neighboring railroads," and when these were executed "not a single rail mill will be at work in the land." The production of iron rails that year amounted to 21,712 gross tons.[1]

The high import duties imposed on iron and steel during and after the Civil War and the great demand for railroad material in the rapidly developing West gave a great impetus to the rail industry. The introduction into the United States of the Bessemer process for making steel created a demand for steel rails as a substitute for iron rails, the latter having reached their maximum output in 1872, when the production amounted to 808,866 gross tons. Since 1882 the production of iron rails has been relatively small, and at the present time it is negligible. The average annual output of steel rails during the seventies was 252,560 tons, but during the succeeding decade this average mounted to 1,310,152 tons.[2] In 1906, the year of maximum production, the output of steel rails in the United States was 3,977,872 tons. In 1917 it was 2,944,161 tons.[3]

The introduction of the open-hearth process has resulted in the substitution of open-hearth steel rails for the Bessemer product. Since 1910 the United States has produced more open-hearth rails than Bessemer rails, and in 1919 over 85 per cent of the rails produced in the United States were of the former kind.[4]

FOREIGN PRODUCTION.

Statistics on rail production in several European countries since 1914 are not at present (1921) available. During the years immediately preceding the outbreak of the war Germany, the leading producer next to the United States, had an annual output considerably in excess of 1,000,000 tons. Great Britain, the third greatest producer, manufactured an annual tonnage of something less than 1,000,000. Russia and France each had an output of approximately half a million tons. Other producers of importance were Belgium, Canada, Austria-Hungary, and Italy. In 1918 Great Britain produced 375,710 tons of steel railway rails. The production of Canada reached 506,709 gross tons in 1913, but declined materially during the war.

The rails which these countries produced and exported were, in the main, heavy rails manufactured out of steel made by the Bessemer process.

IMPORTS.

The importation of rails during the fiscal years 1912–1920 has varied from 3,297 gross tons in 1912 to 55,092 gross tons in 1915. The imports for consumption for the calendar years 1912 to 1919, inclusive, have ranged from 4,025 gross tons in 1912 to 78,525 gross tons in 1915. With the exception of the years 1914, 1915, and 1916, our importation of rails for consumption has been for a long time considerably less than 1 per cent of the domestic production.

In the years immediately preceding the outbreak of hostilities in Europe in 1914 our imports came mainly from Germany and Canada.

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[1] James M. Swank: Our Iron Industry and the Protective Policy, p. 6.
[2] Statistical Abstract, 1916, p. 534.
[3] Figures furnished by Washington office of American Iron and Steel Institute.
[4] Annual Statistical Report of the American Iron and Steel Institute, 1916, p. 37.

In the fiscal years 1912 and 1913 Germany supplied us with over three-fourths of our imported rails. Since 1914 our imports have come almost entirely from Canada, largely through the customs districts of Chicago and Michigan.

The revenue derived from imported rails has not been large. In the fiscal year 1907, with an import duty of $7.84 per gross ton (⅛ cent per pound), the duties collected amounted to $30,670, and in 1909, under the same tariff, the revenue amounted to only $9,122. Between 1909 and 1913 the annual duties collected varied from $14,924 in 1912 to $25,349 in 1910, and during the period from July 1 to October 4, 1913, the date on which the present tariff placing rails on the free list went into effect, $5,332 was collected.

PRICES.

In 1867, when steel rails were first produced in commercial quantities in the United States, the price per gross ton was $166 (currency).[1] By 1885 it had declined to $28.52, after which it rose to $37.08 in 1887. It again declined until the minimum annual average, $17.62,[1] was reached in 1898, but rose again to $32.29 in 1900. From April, 1901, to May, 1916, the prices remained fixed at $28. The present (1921) quotations per gross ton for heavy, standard-section steel rails are: Bessemer, $45; open-hearth, $47.[2]

In England prices have fluctuated more than in the United States. In the years 1910 and 1911 the quotations at mill averaged, in American currency, $26.57 and $27.53 per gross ton, respectively. During 1912–1914, inclusive, prices averaged over $30 per gross ton. After 1914 the effect of the war was noticeable in the marked upward trend of quotations. In 1919 the price per gross ton averaged about $73.

Export prices in rail-manufacturing countries are frequently lower than domestic prices. This is likely to be the case in periods of industrial depression when there is an effort to dispose of surplus stocks in foreign countries which have been accumulated during times of prosperity. The export of rails has been encouraged in some countries by a system of indirect bounties taking the form of lower rates on material destined for foreign consumption than on the same material to be used at home. Reduced prices for raw material to be used in the manufacture of export articles have also been granted in certain instances. These and similar practices have influenced prices of steel rails moving in international trade.

TARIFF HISTORY.

Paragraph 587 of the tariff of 1913 provides for the free admission of "railway bars made of iron and steel and railway bars made in part of steel, T rails and punched iron or steel flat rails."

In 1870 the first specific mention of "steel railway bars" is made in an American tariff. The duty imposed was 1¼ cents per pound ($28 per gross ton) on all steel rails and 1 cent per pound ($22.40 per gross ton) where the rail is part steel. Before 1870 imported steel rails were subject, under a general tariff provision, to an ad valorem duty of 45 per cent. With the exception of the period from 1872 to

[1] Statistical Abstract, 1916, p. 724. [2] Iron Age.

875, during which a horizontal 10 per cent reduction in duties was in operation, the 1870 tariff on rails prevailed until 1883. The law of 1883 imposed a duty of $17 per ton on "steel railway bars and railway bars made in part of steel, weighing more than 25 pounds to the yard." Other railway bars and "iron and steel T rails, weighing not over 25 pounds to the yard" bore duties ranging from $\frac{7}{10}$ cent to $\frac{8}{10}$ cent per pound ($15.68 to $20.16 per gross ton). In the law of 1890 all railway bars and T rails were grouped together in one paragraph and made subject to a duty of $\frac{6}{10}$ cent per pound ($13.44 per gross ton). This tariff was further reduced to $\frac{7}{20}$ cent per pound in the laws of 1894 and 1897 and to $\frac{7}{40}$ cent per pound in the law of 1909.

These successive reductions in duties apparently exercised little permanent influence on importations. After the passage of the act of 1913 the annual importation of rails from Canada rose from a few hundred gross tons in 1912 and 1913 to over 50,000 gross tons in 1915 and 1916. In 1917, however, importation of rails declined to a little over 14,000 tons. As the war practically shut out importation from Europe and railroad building in Canada was greatly restricted at a time when rail mills with large capacity had been completed, it is impossible to draw any conclusion with respect to the effect on imports of putting rails on the free list.

Substantial duties are imposed on rail imports in France, Germany, Italy, and Canada. In France the rate of duty under the general tariff amounts to $0.79 per 100 pounds and $0.53 per 100 pounds under the minimum tariff. In Germany the duty is $0.27 per 100 pounds for ordinary standard rails. Canada, which in recent years has supplied the United States with the bulk of its rail imports, has a general tariff of $7 per ton on "iron and steel railway bars or rails," with an intermediate tariff of $6 per ton and a British preferential tariff of $4.50 per ton.

TARIFF QUESTIONS INVOLVED.

The United States leads the world in the production of steel rails and is practically self-sufficient with regard to most materials entering into their manufacture. This branch of manufacture is to-day maintaining itself without any tariff protection. The large export trade of the United States in steel rails, a trade which antedated the present war, indicates the competitive strength of the American industry even in foreign markets.

While the United States leads the world in the production of rails and exports a large tonnage, the shipment of such a commodity any great distance, especially by land, materially adds to the price charged the consumer. As the principal producers of steel rails in the United States are located mainly in the Middle Atlantic and East North Central States and in the Alabama region, the imported product in districts remote from these regions, especially on the Pacific coast, may be cheaper than the domestic commodity. Water transportation is normally much less costly than land transportation, and articles low in value in proportion to bulk can often be shipped from Europe to our Pacific coast ports at lower rates than they can be transported by rail across the continent. The freight on steel rails from Chicago to San Francisco was $20.16 per gross ton before the

25 per cent increase in rates in June, 1918, after which it became $25. A further increase took place in August, 1920. The same rates have prevailed on shipments from Birmingham, Ala., to San Francisco. From Pittsburgh to the same destination the rates have been from $2 to $3 more. On the basis of the quoted price at Pennsylvania mills before the war began to affect market conditions in this country the freight on steel rails shipped to San Francisco would add 80 per cent to their price at mill. On the basis of present (1921) prices the existing railroad rates would increase the cost to consumer at San Francisco over $30 per gross ton, or approximately 65 per cent. The ability of the rail manufacturer to compete with his foreign rival on the Pacific coast depends in part upon relative rail and water rates from mills in the East and abroad. The importation of rails through the customs districts of the Pacific coast have been small compared with the total for the country. In the year 1910, however, they constituted over 45 per cent of the rail tonnage imported. The great increase in ocean freight rates following the outbreak of the war in 1914, as well as other conditions, prevent for the present any considerable shipments from Europe.

Tariff questions are sometimes raised by common practices, political and commercial, with respect to exports, and such a commodity as steel rails has been subject to the practices in question. Bounties are often given on exported commodities. These bounties are now generally indirect; that is, in the form of reduced transportation rates on exported goods, relatively low prices on raw material entering into the manufacture of commodities to be sent to foreign markets, etc. In periods of financial panic goods are often "dumped" on the foreign market; i. e., sold in large quantities at prices much below those obtained at home. In some countries countervailing and antidumping laws have been passed limiting these practices. In Canada there is an antidumping tax which applies "in respect to iron and steel, rolled, drawn, or polished when the difference between the fair market value and the selling price of such iron and steel to the importer in Canada" exceeds "5 per cent of their fair market value." A dumping tax of this description was recommended for this country by Mr. Gary in 1908 on iron and steel products.

The question of tariff classification arises in the case of light and heavy rails owing to the difference in the material used in their manufacture. When the tariff of 1913 was under discussion the manufacturers of light rails (weight, 40 pounds per yard or less) protested against having their product classed with heavy rails (weighing 50 pounds and more per yard) and put on the free list. The contention was that light rails are made out of larger old rails, of which the supply is limited. Mills producing splice bars, for example, use old steel rails in the manufacture of their products, but are protected by a duty of 10 per cent. The cost of producing splice bars is practically the same as that for the manufacture of light rails, which are unprotected. The producers of the former are the competitors of the manufacturers of the latter in the purchase of the limited supply of old heavy rails with the artificial advantage of a protective tariff. The producers of railway splice bars are enabled to bid higher for their raw material than the producers of light rails.[1]

[1] Tariff Schedules, Briefs, and Statements with Senate Committee on Finance, H. R. Vol. 3, pp 1881–83

COMPETITIVE CONDITIONS.

ompetitive strength of American steel-rail manufacturers in ted States as against manufacturers of other countries may be red with reference to prevailing mill prices, foreign and domes- ort prices with a consideration of "dumping" possibilities; bounties; cost of production at home and abroad; and trans- n in connection with geographical distribution of markets in ted States.

prices, foreign and domestic.—A comparison of the mill prices rails in the United States and in England for the years 1910– hows a higher average[1] for England than for the United (See p. 34.) In England the average was $34.43 per gross ile in the United States it was $28.25, the difference reflecting the more immediate effect of the war upon English than merican prices. During the years unaffected by war con- (1910–1913), the annual average mill price in England varied 6.57 per gross ton in 1910 to $32.23 in 1913. In the United during the same years the Pennsylvania mill price—published 1, 1901—was $28 per gross ton. (See p. 34.)

rding to E. H. Gary's testimony before the Ways and Means tee in 1908, the domestic price of steel rails at that time in y was $29.02; in Great Britain, $27.98; in France, $33.33; Belgium, $27.45.[2] In 1907, according to E. C. Felton, presi- the Pennsylvania Steel Co., the price in Germany was $31

e last four years (1917–1920) prices at home and abroad have uch higher. During year 1918 the prices of steel rails in the States were, Bessemer, $55 per gross ton, and open hearth, In England steel rails were selling for approximately the same In 1921 American prices had declined to $45 for Bessemer 7 for open-hearth rails. The English prices ranged over 25 t higher.

rt prices and dumping.—Export prices are often lower than ic prices, because of a desire on the part of producers to foreign markets, "dumping" during periods of industrial ion, and various artificial encouragements in the way of s, direct or indirect.

Schwab stated in 1908 that manufactured steel rails sold for probably $10 less than at home. "It is a wise process to oad for less than at home."[2] Mr. E. C. Felton testified that the export price of steel rails from his mills was $27.52 f. o. b. rrows Point, Chesapeake Bay. The domestic price which he d was $28.08.

he leading rail-exporting countries, outside of the United there is apparently a marked difference at times between the ic and export prices. In the case of Germany, Great Britain, , and Belgium, the export prices in 1908 were $22.20, $23.61, and $22.50, respectively, as against domestic prices of $29.02, $33.33, and $27.45, respectively.[2]

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m "average" as used here is the simple arithmetic average. As the quantities sold at different are not shown the weighted average is of course impossible.
learings before Committee on Ways and Means, 1908–9, 60th Cong., Pt. I, p. 1743.
1573.
e, January to June numbers.
d Coal Trades Review, January and February numbers.

The difference between the domestic and export price becomes accentuated in periods of depression, especially during the earlier months or the first year of such a condition. The amount of goods already produced or ordered is based upon an earlier period of prosperity, and this product must be disposed of. In order to keep the domestic price from falling, the so-called surplus is sold abroad a prices not infrequently below cost. This "dumping," as it is popularly called, is resorted to by producers in both Europe and America, and has been a feature of the commerce in steel rails. Gary recommended in 1908 a countervailing or dumping tax similar to the one prevailing in Canada. "If Germany, for instance, is proposing to dump its products in this country at any time because business is dull, there ought to be such a tax as would prevent them selling here more than 5 per cent below the price they get in their own country. In that case * * * you would protect this country against dumping." [1]

Export bounties.—The export of steel rails like that of other products, is sometimes encouraged by bounties. These bounties, in the main, are indirect, i. e., in the form of reduced transportation rates or low prices for raw material, rather than in the form of payments directly from the Government. Canada has for a number of years paid bounties on the production of iron and steel, but not on the export of these commodities. Germany, which is often cited as an example of Government-fed industries, pays no direct bounty on the export of steel rails.[1]

In Germany reduced freight rates were given to exporters of steel products on the Government roads.[2] In addition to this well-known form of indirect bounty, encouragement was given to the export of steel products by some of the cartels. In 1897 certain German syndicates adopted an export bounty policy by subsidizing iron and steel manufacturers with respect to goods to be sent out of the country. The unions controlling the output of fuel, iron, raw steel, etc., have supplied such materials at lower prices when required in the manufacture of articles for export than when produced for sale in the home market.[3] An English writer in Cassier's Magazine, referring to German competition in English markets said: [4] "The chief factor in the promotion of Germany's foreign trade these last 10 years has been the policy of granting cooperative bounties." In 1918 reduced railway rates for exports were discontinued in the United States.

Cost of production.—The cost of production in the United States and in foreign countries is stated variously by different persons according to the elements entering into their cost estimates. Furthermore, costs vary considerably with different plants in the same country. Most cost estimates are little more than guesses.

The figures of the Commissioner of Corporations published in 1913 estimated for the United States Steel Corporation the integrated mill costs per gross ton for producing steel rails in 1910 as follows: [5]

Heavy standard Bessemer rails	$15.37
Heavy standard open-hearth rails:	
Northern works	17.35
Southern works	19.24

[1] Tariff Hearings, Ways and Means Committee, 1908 and 1909, p. 1744.
[2] Ibid., pp. 1743-1744.
[3] Daily Consular Reports, May 6, 1911.
[4] Cassier's Magazine, July, 1908.
[5] Report of Commissioner of Corporations on the Steel Industry, Part III, pp. 461-465.

These figures make no allowance for depreciation and general expense, but this allowance was assumed by the commissioner to be about $1.30 per ton in the case of Bessemer rails and $1.55 per ton for northern works and $1.65 per ton for southern works, in the case of open-hearth rails. The cost per gross ton of producing steel rails at mill in 1910 for the United States Steel Corporation, exclusive of any intercompany profit or return on investment, was thus estimated at $16.67 for Bessemer steel rails, $18.90 for northern open hearth, and $20.89 for southern open hearth. These costs, however, were considerably less than the estimated average cost of producing Bessemer rails in the years 1902–1906, for which figures were published for the country as a whole. In the items making up the cost in the case of the United States Steel Corporation the cost of steel ingots constituted 77 to 85 per cent of the total mill cost. Of the cost of converting ingots into rails the labor element constituted about 40 to 50 per cent.

There is no satisfactory evidence that mill costs were lower abroad than in the United States in the period immediately before the war. Prices in Europe, as has been indicated, did not differ greatly from those prevailing in the United States. Unless European manufacturers were receiving exorbitant profits their mill costs were not much, if any, below those indicated in the figures of the Bureau of Corporations.

Since the outbreak of the war costs and prices here and abroad have advanced very materially. In England the price of steel rails at the present time (April, 1921) is approximately 25 per cent more than in the United States.

The Federal Trade Commission, in the determination of the costs of iron and steel products during the war for the use of the price-fixing committee of the War Industries Board and of certain purchasing departments of the Government, obtained the monthly cost sheets of the producing companies showing the average mill cost of producing standard open-hearth and standard Bessemer steel rails from October, 1917, to September, 1918, inclusive. These cost sheets were for mill costs and did not cover general and administrative expenses or general depreciation. At the request of the Tariff Commission for information respecting the proportion of the various items of cost to the mill cost, the Federal Trade Commission compiled the costs as reported by five representative companies. They did not, of course, include any items for interest or for income or excess-profits taxes. If the additional costs for general and administrative expenses and for general depreciation could be determined with accuracy, there would be a substantial addition to the mill cost as shown below.

These data have not as yet been published by the Federal Trade Commission and were furnished to the Tariff Commission with the statement that they were subject to revision. While these figures give the reported mill costs for only five companies, it is believed that they are sufficiently representative to show the relative impor-

tance of the particular items entering into mill costs. For the 12-month period covered these costs were as follows:

	Standard open-hearth rails (per gross ton).	Standard Bessemer rails (per gross ton).
Net metal	$32.91	$40.54
Fuel	.23	.28
Labor	1.73	2.28
Maintenance and repairs	.73	.83
Rolls	.48	.64
Steam and power	.71	.76
Rebuilding and contingent	.05	.06
Other mill costs	.48	.65
Cost above net metal	4.41	5.49
Total mill cost	37.32	46.09

It will be observed that there is quite a spread between the cost of open-hearth and Bessemer rails. The largest portion of this difference is made up in the net metal cost. It should also be noted that in the production of Bessemer rails the percentage manufactured by high-cost companies was very much in excess of the percentage of open-hearth rails manufactured by these same companies. The high cost of Bessemer rails is due in part to the fact that out of a total of 312,390 tons the high-cost companies manufactured almost 50 per cent, while out of 1,663,347 tons of open-hearth rails these same companies produced approximately only 14 per cent.

Speaking generally, the 12 months from October, 1917, to September, 1918, embraced a period of rising costs, due in part to advancing wages and increased freight rates after June, 1918, which materially augmented the expense of assembling material.

Transportation and geographical conditions.—Cost of transportation is an important element in determining the price of steel rails to the consumer, because rails are a heavy and bulky commodity compared with the price charged. Shipment any great distance, especially by land, materially adds to the price charged the consumer. As the principal producers of steel rails in the United States are located mainly in the Middle Atlantic and East North Central States and in the Alabama region, the importation of steel rails in substantial amounts in other parts of the country, especially near the seacoast, is a possibility even where the mill costs in the countries of origin may be greater than in the United States.

The transportation rates on rails per gross ton in carload lots from Chicago, Pittsburgh, and Birmingham to important ports were obtained from the Interstate Commerce Commission for the period just preceding the 25 per cent increase in railroad rates in June, 1918, and the new rates effective from that time until August, 1920, when the rates were again raised. These rates were as follows:

	Before 25 per cent increase in June, 1918 (per gross ton).	After 25 per cent increase in June, 1918 (per gross ton).		Before 25 per cent increase in June, 1918 (per gross ton).	After 25 per cent increase in June, 1918 (per gross ton).
From Chicago to—			From Pittsburgh to—Contd.		
New York	$5.70	$7.10	Mobile	$4.70	$5.90
Buffalo	3.40	4.30	New Orleans	4.70	5.90
Mobile	4.25	5.30	San Francisco	22.40	28.00
New Orleans	4.25	5.30	From Birmingham (Ala.) to—		
San Francisco	20.16	25.00	Mobile	2.50	3.10
From Pittsburgh to—			New Orleans	3.00	3.80
New York	3.20	4.00	San Francisco	20.16	25.00
Buffalo	2.00	2.50			

As the quoted prices of heavy standard-section steel rails in the United States are the Pennsylvania mill prices the prices at San Francisco, on the basis of the rail rates and quoted prices ($55 and $57 per gross ton for Bessemer and open-hearth steel, respectively) for the latter half of 1918 and 1919 were under ordinary conditions approximately 50 per cent greater than the Pittsburgh prices. On the basis of the old $28 per ton quotation, the rail rate from Pittsburgh, before the 25 per cent increase of June, 1918, would add 80 per cent to the price at San Francisco.

In normal times ocean freight rates are much lower than rail rates. Rails shipped from Europe to the Pacific coast of the United States go ordinarily in tramp vessels with fluctuating rates. These rates have been considerably less than the rail rates from the mills of Pittsburgh, Chicago, and Birmingham. It has been urged that a substantial tonnage of imported rails has been sold on the western coast of this country at prices below cost to manufacturers in the East.[1]

Notwithstanding this apparent advantage on the part of European producers over domestic manufacturers very little use seems to have been made of it. The country's aggregate imports from Europe have for many years been small—in no year from 1907 to 1919, inclusive, being as much as 5 per cent of the domestic production. Of the total imported product only a moderate percentage came into the United States through customs districts on the Pacific coast. In the fiscal year 1910 over 45 per cent came through the ports of Los Angeles, Puget Sound, and San Francisco, but this proportion was exceptional and amounted only to 3,265 tons.

The great increase in ocean freight rates since the beginning of the great war in Europe, as well as other conditions, have prevented such shipments from European countries in late years.

The proximity of location and cheap water transportation resulted in a comparatively large importation of steel rails from Canada during the years 1915 and 1916. In a Canadian Government publication attention is called to the falling off of steel-rail importations since

[1] In the tariff hearings before Ways and Means Committee, Sixtieth Congress, Mr. Gary gave the rates from foreign mills in Germany and England to leading ports of the United States and Canada as follows:

Foreign mills to—	Rails, gross ton.
New York	$2.85
Mobile	3.35
San Francisco	7.50
New Orleans	3.35
Montreal	2.75

(See pp. 1741 and 1742.)

the establishment of the rail mills at Sydney, Nova Scotia, and at Sault Ste. Marie, and the export of rails especially to the United States.[1] The location of the steel mills at Sault Ste. Marie gives them cheap water transportation on the Great Lakes. It is significant that of the total importation of steel rails into this country in 1915, amounting to 55,092 gross tons, 42,857 gross tons, or 78 per cent, came through the customs districts of Chicago and Michigan. In 1916, out of a total importation of 53,944 gross tons—all from Canada—42,158 gross tons came through the same two districts.

Rails—Production in United States—States.

[From United States Census.]

State.	1899		1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*	
Pennsylvania [1]	1,218,289	$24,597,034	812,691	$20,204,210	818,924	$24,077,184	566,125	$16,197,964
Ohio	[2] 142,918	[2] 4,143,069	[2] 107,603	[2] 3,194,504				
All other	890,130	17,793,056	[3] 1,274,251	34,858,038	2,009,675	57,051,111	1,275,916	37,811,884
Total	[4] 2,251,337	[4] 46,533,159	[5] 2,194,605	[5] 58,256,750	[6] 2,858,599	[6] 81,128,295	1,842,041	54,009,848

[1] U. S. Census 1910, Vol. IX, p. 1063.
[2] U. S. Census 1905, Part II, p. 831.
[3] A large tonnage was produced in Illinois in 1905; it amounted to about 25 per cent of the total for the country. (Census 1905, Pt. II p. 201.) (This tonnage, however was not separately listed, as entire production of State was by one concern.
[4] U. S. Census 1900, Vol. X, p. 59.
[5] U. S. Census 1905, Special Rep., Pt. I, p. CLI.
[6] Figure is for steel rails only. (U. S. Census 1910, Vol. VIII, p. 407.)

[From Annual Statistical Report of the American Iron and Steel Institute.]

State.	1908	1909	1910	1911	1912	1913
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Pennsylvania	493,008	855,707	986,702	839,663	888,672	971,839
New York						
New Jersey		621,373	711,975	490,980	585,817	654,207
Maryland						
West Virginia						
Alabama		367,039	496,716	447,905	622,121	657,912
Ohio						
Indiana						
Illinois						
Wisconsin		1,179,726	1,140,638	1,044,242	1,231,305	[a] 1,218,841
Colorado						
Washington						
California						
All other	1,428,007					
Total	1,921,015	3,023,845	3,636,031	2,822,790	3,327,915	3,502,799

State.	1914	1915	1916	1917	1918	1919
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Pennsylvania	592,532	694,545	707,851	769,419	747,801	630,339
All other	1,352,563	1,509,658	2,146,667	2,174,742	1,793,091	1,573,504
Total	1,945,095	2,204,203	2,854,518	2,944,161	2,540,892	2,203,843

[a] In this figure California is not mentioned.

NOTE.—After 1913 the annual reports of the American Iron and Steel Institute give figures for the country as a whole and for Pennsylvania only, among the States.

[1] *Annual* Report on Mineral Products of Canada, published by the Department of Mines, p. 117.

Rails—Production in principal foreign countries.

ountry.	1907	1908	1909	1910	1911	1912
	Gross tons.[1]	*Gross tons.*[1]	*Gross tons.*[1]	*Gross tons.*[1]	*Gross tons.*[1]	*Gross tons.*[1]
.....	311,461	268,692	344,830	366,465	360,547	423,885
.....	344,513	390,205	[2] 419,767	498,467	449,818	[2] 531,304
ıcluding Luxem-						
.....	1,409,915	1,213,330	1,126,392	1,242,030	.....	[3] 1,928,824
.....	314,760	[2] [3] 191,370	[2] [3] 214,000	347,890	.....	.....
.....	75,000	67,710	123,290	121,370	107,431	.....
ıgary.....	163,055	259,865	207,211	155,839	205,659	.....
n.....	912,108	907,632	929,633	[4] 947,606	[4] 836,525	.....
.....	311,806	361,669	500,626	[5] 497,370	520,228	.....
.....	.....	.....	28,500	[6] 33,248	24,215	.....
.....	.....	.....	25,056	23,546	.....	.....
.....	38,144	59,833	58,044	45,565	47,524	.....

r.	1913	1914	1915	1916	1917	1918	1919
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
.....	506,709	382,344	209,752	81,497	41,349	145,309	282,415
.....	[7] 430,760	.....	.....	.....	.....	.....	.....

ic ton (2,204 pounds) is the unit used, except in United Kingdom, United States, and Canada ıglo-Saxon countries.
'ears 1908 and 1909 different figures are given for the same years in the case of France and Bel- figures used are those of the later publication in each case.
"Sleepers."
fishplate and sleepers.
ent figures are given for Russia in 1910 and Mexico in 1909. The later figures in each case those used.
fastenings.
sleepers and fishplates.

gures for 1907 to 1911, inclusive, were derived from the reports of the American Iron and Steel ppearing in years 1908–1912, inclusive. In the case of Canada the figures were those appearing ssue of the Annual Statistical Report of the American Iron and Steel Institute. Figures for 1912 and of France in 1912 and 1913 were taken from the Iron and Coal Trades Review, London, , p. 387, and Apr. 10, 1914, p. 541.

Rails—Imports by countries (fiscal years).

from—	1910		1912		1913		1914	
	Gr. tons.		*Gr. tons.*		*Gr. tons.*		*Gr. tons.*	
.....	714	$16,230	141	$4,383	145	$2,887	1,115	$30,767
.....	37	977	20	278	.....	.....	.....	.....
.....	1,900	49,609	2,778	73,902	3,991	103,361	2,838	76,672
dom:								
.....	249	8,253	201	5,385	70	1,877	596	19,500
.....	2,481	58,911	135	2,775	622	11,010	10,958	222,600
.....	.....	.....	22	669	.....	.....	.....	.....
.....	1,545	24,405	.....	.....	196	6,006	.....	.....
.....	14	281	.....	.....	.....	.....	.....	.....
.....	7,030	158,666	3,297	87,392	5,024	125,141	15,507	349,539

rom—	1915		1916		1917		1918	
	Gr. tons.		*Gr. tons.*		*Gr. tons.*		*Gr. tons.*	
.....	805	$19,879	.....	.....	.....	.....	.....	.....
.....	1,491	40,649	.....	.....	.....	.....	.....	.....
.....	52,796	1,503,090	53,944	$1,373,764	14,065	$402,810	7,520	$278,044
.....	.....	.....	.....	.....	.....	.....	865	20,807
.....	.....	.....	.....	.....	2	77	.....	.....
.....	55,092	1,563,618	53,944	1,373,764	14,067	402,887	8,385	298,851

mmerce and Navigation, 1912, p. 273. No separate figures are given for the year 1911, the Rails for railways" being included under the general head of "Other manufactures of." See Imports for consumption" for 1911.

Rails—Imports by countries (calendar years).

Imported from—	1918		1919	
	Tons.		*Tons.*	
Canada	8,220	$331,028	15,328	$594,228
Mexico	485	10,957	1,680	57,662
Total	8,705	341,985	17,008	651,890

Rails—Imports for consumption—Revenue.[1]

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
	Per ton.	*Gross tons.*				*Per cent.*
1907	$7.84	3,939.00	$107,308.50	$30,885.45	$27.22	28.78
1908	$7.84	3,042.69	91,746.83	23,854.56	30.15	26.00
1909	$7.84	1,343.91	36,001.70	10,536.25	26.79	29.27
1910[2]	$7.84					
1910[3]	$3.92	6,928.38	156,089.00	27,160.59	22.53	17.40
1911	$3.92	4,296.54	103,807.66	16,842.42	25.56	15.34
1912	$3.92	3,940.21	103,523.00	15,445.60	26.27	14.92
1913	$3.92	5,047.97	125,641.68	19,788.09	24.89	15.75
1914	$3.92	1,371.41	34,689.00	5,375.93	25.29	15.50
1914	Free	6,226.50	171,487.00		27.54	
1915	do	55,092.00	1,563,618.00		28.38	
1916	do	53,944.00	1,373,784.00		25.74	
1917	do	14,135.00	405,701.00		28.70	
1918	do	8,385.00	298,851.00		35.64	
1919	do	16,281.00	671,511.00		41.25	
1920	do	23,804.00	874,857.00		36.75	

[1] From Foreign Commerce and Navigation of the United States.
[2] To Aug. 5, 1909. From July 1 to Aug. 5, 1909, when the act of 1909 was still in force, no figures are given in Foreign Commerce and Navigation of the United States.
[3] From Aug. 5, 1909, to June 30, 1910.

Rails—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Canada	27,275	$801,084	39,065	$1,168,101	118,726	$3,369,884
Panama	13,543	413,169	7,786	230,781	8,491	254,651
Mexico	67,920	1,906,640	63,812	1,838,585	32,459	853,758
Cuba	40,012	1,105,773	30,591	904,028	37,606	1,094,304
Argentina	80,261	2,317,312	47,917	1,327,754	30,484	862,511
Brazil	35,367	1,031,774	20,881	633,592	40,730	1,187,492
Chile	6,192	179,970	14,131	418,683	44,137	1,309,525
Japan	12,355	363,724	18,375	1,467,337	37,513	1,118,942
Australia and Tasmania	52,140	1,417,538	59,406	1,714,502	25,060	744,822
Philippine Islands	4,684	145,004	11,276	345,409	2,811	82,980
All other	29,811	854,142	45,768	1,313,672	39,530	1,155,597
Total	369,578	10,546,180	391,428	11,377,444	417,547	12,134,445

Rails—Domestic exports—(fiscal years)—Continued.

rted to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
rope					12,275	$356,952
	138,439	$3,980,657	115,666	$3,415,167	7,676	230,111
	19,979	551,576	3,119	101,705	1,874	64,633
	31,742	949,870	29,477	908,280	24,191	670,086
	24,773	695,018	28,424	861,281	5,332	143,880
	31,629	1,031,884	45,367	1,529,309	4,224	128,082
	13,939	458,827	7,302	253,166	13,332	372,777
	11,069	322,542	12,998	367,801	11,409	320,866
	41,554	1,267,264	17,964	502,573	7,894	216,926
	57,690	1,793,234	9,655	300,808	23,999	649,210
ands	11,587	347,914	16,452	460,523	639	21,353
	70,144	2,030,525	52,189	1,558,496	46,742	1,363,102
	452,545	13,429,311	338,613	10,259,109	159,587	4,537,978

rted to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
	83,114	$2,917,442	157,055	$6,895,977	118,618	$6,037,458
ope	114,481	3,960,784	76,957	3,528,970	31,028	1,467,220
	11,106	369,650	69,384	2,661,427	43,819	1,965,464
	3,609	123,652	1,750	72,341	4,118	233,798
	53,391	1,536,314	75,015	2,650,753	61,660	3,172,699
	5,486	161,605	132	5,026	20	1,968
	4,097	137,092	1,878	86,420	418	26,454
	8,470	238,313	15,921	713,514	7,284	334,273
	118	5,577	1,393	51,539	2,586	170,565
	1,287	44,869	28,214	1,347,004	106,940	6,653,272
i	159,408	5,278,105	40,620	1,858,435	16,263	742,090
	20,291	661,498	1,206	48,550	250	14,162
ands	9,540	287,834	1,890	102,372	3,507	226,542
	63,520	1,909,021	122,974	5,083,141	33,836	1,831,437
	537,918	17,631,756	594,389	25,405,469	430,347	22,817,400

Rails (railway-steel)—Domestic exports (calendar years).

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
			29,605	$1,716,708
	172,231	$9,725,691	141,261	8,220,504
	80,329	2,467,019	23,040	1,579,948
			4,412	255,366
	4,025	98,418	7,117	407,510
	66,558	3,163,301	25,580	1,064,417
	1,226	86,156	10,670	461,681
	46,498	2,783,149	57,281	3,218,651
			5,816	531,149
	5,896	335,420	11,146	675,177
	3,058	180,055	8,227	509,860
	1,366	101,273	46,151	3,127,955
	75	4,823	4,279	282,465
idies	1,963	154,189	29,536	1,672,801
	80,865	5,521,437	152,997	9,621,479
	5,109	235,772	11,115	678,814
	6,265	413,692	13,997	801,496
Africa	3,115	211,429	23,817	1,590,463
	14,867	922,040	43,396	2,560,393
	453,537	26,402,864	652,443	38,986,855

Kwangtung.

Steel rails, heavy, standard section; prices at mills in Pennsylvania.[1]

[From Iron Age and annual statistical reports of the American Iron and Steel Institute.]

Kind or grade.	April, 1901, to December, 1915.[1]	1916	1917	1918	1919	1920
	Per gross ton.	*Per gross ton.*	*Per gross ton.*	*Per gross ton.*	*Per gross ton.*	*Per gross ton.*
Bessemer:						
Average	$28.00	$32.00	$38.00	$55.00	$47.31	$52.33
Highest	28.00	38.00	38.00	55.00	55.00	55.00
Lowest	28.00	28.00	38.00	55.00	45.00	45.00
Open hearth:						
Average	28.00	.....	40.00	57.00	49.31	.....
Highest	28.00	40.00	40.00	57.00	57.00	57
Lowest	28.00	28.00	40.00	57.00	47.00	47

[1] Computed from monthly averages of weekly quotations.

Rails, standard section—Prices at mills in England.

[From annual statistical reports of American Iron and Steel Institute—compiled from weekly quotations in Iron and Coal Trades Review.]

Kind or grade.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Average for year	$26.57	$27.53	$30.23	$32.23	$30.86	$40.52	$53.09	$52.92	$52.92	$73.20
Highest monthly average	26.76	27.97	32.53	32.84	32.84	51.21	53.53	52.92	52.92	83.94
Lowest monthly average	26.15	27.21	27.52	31.63	28.58	31.75	52.95	52.92	52.92	52.92

Miscellaneous Tables.

United States.

Production of rails according to kind, 1909–1919.[1]

Years.	Open hearth.	Bessemer.	Rerolled.[2]	Electric.	Iron.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1909	1,256,674	1,767,171	.....	(3)	.....	3,023,845
1910	1,751,359	1,884,442	.....	(3)	230	3,636,031
1911	1,676,923	1,053,420	91,751	462	234	2,822,790
1912	2,105,144	1,099,926	119,390	3,455	.....	3,327,915
1913	2,527,710	817,591	155,043	2,436	.....	3,502,780
1914	1,525,851	323,597	95,169	178	.....	1,945,095
1915	1,775,168	326,952	102,183	.....	.....	2,204,203
1916	2,269,600	440,092	144,826	.....	.....	2,854,518
1917	2,292,197	533,325	118,639	.....	.....	2,944,161
1918	1,945,443	494,193	101,256	.....	.....	2,540,892
1919	1,893,250	214,121	96,422	50	.....	2,203,843

[1] Annual statistical reports of the American Iron and Steel Institute.
[2] Rerolled from old steel rails. Included with Bessemer and open-hearth steel rails in 1910 and before.
[3] Small tonnage rolled in 1909 and 1910 included with Bessemer and open-hearth rails for these years.

Production of rails, by weight per yard, 1913–1919.[4]

Year.	Under 50 pounds.	50 and less than 85 pounds.	85 and less than 100 pounds.	100 pounds and over.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1913	270,405	967,313	2,265,062		3,502,780
1914	238,423	309,865	868,104	528,703	1,945,095
1915	254,101	518,291	742,816	688,995	2,204,203
1916	295,535	599,791	1,225,341	706,851	2,854,518
1917	308,258	882,673	989,704	763,526	2,944,161
1918	395,124	665,165	888,141	592,462	2,540,892
1919	263,803	495,577	965,571	478,892	2,203,843

[4] Annual statistical reports of the American Iron and Steel Institute.

duction of steel rails by the United States Steel Corporation and independents, 1902 and 1910–1919.[1]

Year.	United States Steel Corporation.	Independents.	Total.[2]	Percentage of United States Steel Corporation.
	Gross tons.	*Gross tons.*	*Gross tons.*	
02	1,992,010	949,411	2,941,421	67.7
10	2,138,946	1,496,855	3,635,801	58.8
11	1,583,942	1,238,614	2,822,556	56.1
12	1,872,772	1,455,143	3,327,915	56.27
13	1,944,352	1,558,428	3,502,780	55.51
14	985,082	960,013	1,945,095	50.64
15	1,140,605	1,063,598	2,204,203	51.75
16	1,551,956	1,302,562	2,854,518	54.37
17	1,612,859	1,331,302	2,944,161	54.78
18	1,480,499	1,060,393	2,540,892	58.27
19	1,365,587	838,256	2,203,843	61.96

[1] Figures for 1910–1919 are taken from the annual statistical reports of the American Iron and Steel Association and its successor in 1912, the American Iron and Steel Institute. For 1902, the figures of Swank in "Our iron industry and the protective policy" are taken. The percentage for Bessemer rails alone is 65.4 in 1902. See first annual report of United States Steel Corporation. Also Berglund: "The United States Steel Corporation."

[2] Includes rerolled in addition to new rails.

Geographical distribution of rail mills.

States.	Bessemer mills.	Open-hearth. mills.	Total.	States.	Bessemer mills.	Open-hearth mills.	Total.
ew York	1	1	2	Illinois	2	1	3
ew Jersey	1	.....	1	Indiana	.....	1	1
ennsylvania	4	5	9	Colorado	1	1	2
aryland	2	2	4	Washington	1	.....	1
est Virginia	1	.....	1	California	1	1	2
abama	1	4	5				
io	1	2	3	Total	16	18	34

Court and Treasury Decisions.

Decisions have been rendered upon importations of iron or steel ails under provisions of various tariff acts for scrap iron or steel. he leading cases in construction of three representative provisions ollows:

Dwight *v.* Merritt (140 U. S., 213, 1891):

Completed rails, somewhat rusty but never in actual use, were eld dutiable at 70 cents per hundred pounds as "iron bars for ailroads" under section 2504 of the Revised Statutes, Schedule E, nd not under the provision in the same schedule and section read- ng: "Wrought scrap-iron of every description: eight dollars per ton. ut nothing shall be deemed scrap-iron except waste or refuse iron *hat has been in actual use, and is fit only to be remanufactured.*"

Illinois Central Railroad Co. *v.* McCall (147 Fed., 925, 1904):

New steel rails depreciated in value because of defects, but which ave not lost their character or identity as rails, were held dutiable t four-tenths of 1 cent per pound as "rails" under paragraph 130 of ie act of 1897, and not under the provision in paragraph 122 read- g: "* * * wrought and cast scrap iron, and scrap steel, four dollars r ton; but nothing shall be deemed scrap iron or scrap steel except aste or refuse iron or steel *fit only to be remanufactured.*"

Benjamin Iron and Steel Company *v.* U. S. (2 Ct. Cust. Appls., 159, 1911):

Old steel rails, so broken, worn and damaged as to be unfit not only for the uses for which they were originally manufactured, but also for the secondary purpose and less exigent needs of contractors' or industrial railways, were held dutiable at seven-fortieths of 1 cent per pound as "rails" under paragraph 126 of the act of 1909, and not under paragraph 118 reading: "* * * wrought and scrap iron, and scrap steel, one dollar per ton; but nothing shall be deemed scrap iron or scrap steel except waste or refuse iron or steel *fit only to be remanufactured by melting* * * *."

To bring old steel rails within the provisions of paragraph 118 of the act of 1909 for scrap steel the burden was on the importer to show that the importation was not only of scrap steel, but that it was such scrap steel as constituted "waste or refuse * * * steel fit only to be remanufactured by melting." (Benjamin Iron & Steel Co. *v.* United States, 2 Ct. Cust. Appls., 159 of 1911.)

Rails—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	146	Iron railway bars, weighing more than 25 pounds to the yard....	$\frac{1}{10}$ cent per pound.
1883	147	Steel railway bars and railway bars made in part of steel, weighing more than 25 pounds to the yard.	$17 per ton.
1888	149	Iron or steel T rails, weighing not over 25 pounds to the yard.....	$\frac{4}{10}$ cent per pound.
		Iron or steel flat rails, punched.....	$\frac{5}{10}$ cent per pound.
1890	141	Railway bars, made of iron or steel, and railway bars made in part of steel T rails, and punched iron or steel flat rails.	$\frac{4}{10}$ cent per pound.
1894	117	.....do.....	$\frac{2}{10}$ cent per pound.
1897	130	.....do.....	Do.
1909	126	.....do.....	$\frac{1}{10}$ cent per pound.
1913	587	.....do.....	Free.

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UNITED STATES TARIFF COMMISSION

WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPH 110 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

STEEL

Paragraph 110:
- **Steel Ingots, etc.**
- **Shafting**
- **Steel Castings**
- **Steel Bars**
- **Alloy Steels**
- **Tool Steels**

Paragraph 110—continued:
- **Substitutes for Tool Steel**
- **Dies, Die Blocks, etc.**
- **Sheets and Plates** (see par. 105).

Paragraph 613:
- **Steel Ingots**

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the Free List, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.
2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for, and, if discussed under a different paragraph, the number of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by the use of this "Introduction and Index" the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of P. M. Tyler, Abraham Berglund, and Walter Graham of the Metals Division of the Commission's staff, and of others.

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INTRODUCTION.

It will be noted that a great variety of iron and steel products are listed under paragraph 110. The products divide into three general classes:

(1) Bessemer and open-hearth steel in the form of steel bars, mill shafting, hammer and gun-barrel molds, all kinds of castings, and sheets and plates; (2) crucible, electric, or cementation steel in the same forms and in those of ingots, blooms, slabs, die blocks and billets; and (3) steel, however made, containing alloys of certain specified elements.

The first class is dutiable at 8 per cent ad valorem, the second and third classes at 15 per cent.

The Tariff Commission has not prepared surveys covering all the articles specifically mentioned in this paragraph, since in certain instances the products which receive specific mention are not of sufficient commercial importance to warrant extensive investigation.

Mill shafting is included in an accompanying survey on shafting of all kinds. *Sheets and plates* are discussed in another pamphlet, since most classes of sheets and plates are more specifically provided for in other paragraphs of the tariff act. *Steel bars, steel castings,* and *substitutes for tool steels* are covered in the separate surveys in this pamphlet. *Steel* ingots, including those made by the Bessemer and open-hearth processes and specifically provided for on the free list (par. 613), are also included.

Pressed, sheared, or stamped shapes, as mentioned in this paragraph, refer to semifinished or finished forms of iron or steel which have received no treatment beyond pressing, hammering, or stamping. Structural shapes of nickel steel were held to be dutiable under this designation (7 Ct. Cust. Appls., 212, of 1916) as well as certain bent bars. The designation, however, is a general one and most of the articles that might be so described are more specifically provided for in the tariff act. Pressed metal goods (hollowware, etc.) are finished products classed under paragraph 167 (q. v.). *Die Blocks* and *Die Blanks* are included in the report on "*Dies*" incorporated in this pamphlet.

"*Hammer molds or swaged steel*" is a designation difficult to interpret. There is a rolled product which somewhat resembles a notched bar and which may be cut up into forms suitable for the manufacture of hammer heads, that may occasionally be referred to as "hammer molds." Swaged steel seems to be a general term that might be applied to any steel upon which a swage or form has been used in forging it—as in the manufacture of a bar under a hammer or certain classes of drop forgings.

"*Gun barrel molds,* not in bars," was doubtless written into the tariff paragraph to cover short-tapered bars suitable for the manufacture of gun barrels. The reason for the designation "molds" is not clear and apparently does not obtain in the trade where they are called gun-barrel blanks. These articles may be made either by forging or rolling; the more modern method of manufacture is by

rolling through eccentrically grooved rolls. "Shotgun barrels, in single tubes, forged, rough bored" are on the free list (par. 597). Gun-barrel molds were formerly largely imported, owing to the fact that the Belgian product was superior to that made in other parts of the world. Their manufacture in the United States, and also in England, is to a large extent a war development. At present both these countries are in a position to satisfy home requirements, both as to quantity and quality.

It has been brought to the attention of the commission that the administration of the provisions under this paragraph is extremely difficult. In certain instances it is possible, by means of chemical and physical tests, to establish with some certainty the method by which steel was manufactured. In a great many cases, however, it was impossible to do so. In view of the extreme difficulty of determining the process by which the steel was made, the classification of many of the articles described in this paragraph depends wholly upon the declaration on the invoice. It has been charged that it is quite possible for high-grade steel made by the electric furnace or crucible process to be falsely classed as an open-hearth steel dutiable at the lower rate. On the other hand, there are certain classes of steel made by the open-hearth process and legally admitted under the lower rate, which compare quite favorably with steels made in the electric furnace or crucible. In order to obviate the present difficulty attending the determination of the proper classification of steels provided for in this paragraph, it has been suggested that a distinction be based upon chemical composition instead of process. In the case of alloy steels as distinct from plain carbon steel, such distinction now exists, but since practically all the steels made commercially by the crucible, electric, or cementation process when not containing alloys, together with competing steels, made by the open-hearth process, are classed as special steels which almost without exception are high in carbon, it would seem possible to fix a carbon limit, regardless of the method of manufacture.

The bulk of the steel trade, except steel rails which are specifically mentioned in the tariff, is in mild steel, containing less than 0.30 per cent carbon, whereas the special steels ordinarily contain 0.60 per cent or more of carbon.

STEEL INGOTS, CASTINGS, BLOOMS, BILLETS ETC.

SUMMARY.

Steel production is measured in terms of ingots and castings, the former term being applied to steel to be subjected to rolling or forging, and the latter to steel not subjected to these processes. Early modifications of the steel ingot by preparatory rolling take place in cogging, blooming, slabbing and billet mills, resulting in the production of cogged ingots, blooms, slabs, and billets. Ingots, blooms, and slabs are not ordinarily commercial products in the United States. Billets, however, which constitute an early form out of which a variety of steel commodities are made, are an important commercial product.

Practically all steel is now manufactured by the Bessemer, open-hearth, crucible, electric, and cementation processes. When made by the first two processes it is manufactured in large amounts and at relatively low cost, and when made by the other processes production is more limited and the cost is greater. The cheaper steel is used in the manufacture of such articles as rails, structural shapes, heavy plates and sheets, and the more expensive, in the production of commodities like cutlery, and scientific and surgical instruments. Of the total steel output of the United States in 1919 over 98 per cent was produced by the open-hearth and Bessemer processes. Steel is also alloyed with other metals like tungsten, nickel, vanadium, etc., in its manufacture for highly specialized uses.

In 1917 and 1918 the output of the United States amounted to approximately 45,000,000 gross tons each year and probably constituted between 40 and 50 per cent of the total production of the world. In 1919 it was 34,671,232 gross tons. From 1910 to 1915, inclusive, less than 1 per cent of the steel output of this country was exported in the form of ingots, blooms, and billets. After 1915, owing to war conditions, the proportion greatly increased, amounting to nearly 4½ per cent in the fiscal year of 1918. In the calendar year 1919 the export of steel in these forms declined to 258,424 tons, or about 0.75 per cent of the domestic output.

The importation of steel in the forms of ingots, castings, blooms, and billets is insignificant compared with home production—in the years 1910–1918 the ratio to domestic output averaging less than 0.1 per cent. The importation of steel made by the more expensive processes forms a much larger ratio to the total amount of this kind of steel produced than does the importation of the Bessemer and open-hearth product to the total output of the cheaper steel.

The resources of the United States in iron ore and coal, combined with the use of machinery and the latest technical devices, enables the American manufacturer to produce Bessemer and open-hearth steel ingots and other forms of crude steel as cheaply as they can be made in any other part of the world. In the case of steel manufactured by more expensive processes, like the crucible and electric, the conditions of production are different. With smaller output the cost

per unit is greater, the kind of pig iron used is more limited, some of the pig iron is imported, and where the electric process is used, hydroelectric power is relatively expensive.

The tariff of 1913 made a distinction between steel made by the Bessemer and open-hearth processes and steel manufactured by the crucible, electric, and cementation processes or alloyed with other metals. Ingots, blooms, billets, etc., made by the former and not containing alloys were placed on the free list, although on Bessemer and open-hearth steel castings a duty of 8 per cent ad valorem was imposed. On ingots, castings, blooms, billets, and the like, manufactured by the crucible, electric, and cementation processes or containing alloys, the rate was made 15 per cent ad valorem. In earlier tariffs specific rates were generally imposed varying with the value of the steel.

Steel ingots, castings, blooms, billets, etc.—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption.	Domestic exports.[2]	Ratio to production.		Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
				Imports.	Exports.				
	Gross tons.	*Gross tons.*	*Gross tons.*	*Per ct.*	*Per ct.*				
1910	26,094,919	37,952.20	51,554	0.14	0.19	$3,672,729	$799,414	$96.77	21.77
1911	23,676,106	35,781.03	186,540	.15	.79	3,368,274	736,096	94.14	21.85
1912	31,251,303	21,490.80	234,381	.07	.75	2,448,990	538,341	113.96	21.98
1913	31,300,874	19,593.36	230,728	.06	.74	3,441,256	736,353	175.63	21.40
1914	23,513,030	36,486.66	46,926	.16	.20	3,318,427	468,141	90.95	[3]14.12
1915	32,151,036	24,791.29	220,416	.08	.69	2,170,173	288,773	87.53	[3]12.38
1916	42,773,680	24,676.33	962,097	.06	2.25	2,797,964	301,546	113.39	[3]10.78
1917	45,060,607	27,924.38	1,935,026	.06	4.29	2,966,044	280,504	106.22	[3]9.39
1918	44,462,432	44,925.78	1,970,831	.10	4.43	3,799,020	256,603	84.56	[3]6.76
1918[4]	44,462,432	40,690.05	1,786,189	.09	4.02	3,507,934	260,930	86.21	[3]7.44
1919[4]	34,671,232	14,902.43	258,424	.04	.75	2,578,763	280,685	173.04	[3]10.88

[1] Calendar year.

[2] Does not include steel castings. In the exports of castings published in Commerce and Navigation only values are given and the figures include a large amount of iron castings. Hence they are valueless for this table.

[3] Under the tariff of 1913, steel ingots, etc., made by the Bessemer and open-hearth processes, not containing alloys, are admitted free; on steel castings made by the Bessemer, open hearth and similar processes an ad valorem rate of 8 per cent was imposed, and on steel ingots, etc., made by the crucible, electric, and cementation processes, an ad valorem rate of 15 per cent. The rates given in this column are simply averages of duties collected on all the imports within this group of crude steel products. The high general average for 1914, 1915, and 1916 is due to the high value of the dutiable steel. The decline in the rate from 1914 to 1918 is due to the increasing proportion of the free steel imported under war conditions. (See Imports for consumption table, infra.)

General Information.

ACT OF 1913.

Paragraph 613 puts on the free list "steel ingots, cogged ingots, blooms and slabs, die blocks or blanks, and billets, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloy, such as nickel, cobalt, vanadium," etc.

Paragraph 110 * * * "all descriptions and shapes of dry sand, loam, or iron molded steel castings, sheets, and plates; all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium," etc., "8 per centum ad valorem; steel ingots, cogged ingots, blooms and slabs, die blocks or blanks; billets and bars * * *, all the foregoing when made by the crucible, elec-

ic, or cementation process, either with or without alloys, and ished by rolling, hammering, or otherwise, and all steels by whatver process made, containing alloys, such as nickel, cobalt, vanaium," etc., "15 per centum ad valorem."

DESCRIPTION.

Steel production is measured in terms of ingots and castings, which are first forms which all steel products assume before being manufactured into finished shapes or fabricated material. Early modifications of the steel ingot—blooms, billets, and slabs—are often grouped with ingots in general trade statistics. Ingots, blooms, slabs, and occasionally billets, are sometimes called crude steel.

The value and uses of crude steel are largely determined by the process of manufacture. Almost all steel is now made by the Bessemer, open-hearth, crucible, electric, and cementation processes. When made by the first two of these processes it is manufactured in large amounts and is relatively cheap. Out of such steel are produced rails, structural shapes, heavy plates and sheets, barb wire, wire nails, heavy machinery, and the like. Steel made by the other processes named is produced in much smaller amounts, is more expensive, and is used in the manufacture of cutlery, scientific and surgical instruments, etc.

Steel is a form of iron practically free from slag and containing a limited amount of carbon—from a trace to 2.20 per cent. It differs from wrought iron (the purest form of iron) in being free from slag and generally in containing more carbon, and from cast iron in having less than 2.2 per cent carbon—as a rule, less than 1.5 per cent.[1]

Steel ingot is the first solid form which the bulk of the pig iron produced takes after its conversion into steel. It is simply an oblong block, varying considerably in size and shape. The Bessemer and open-hearth ingot is usually about 6 feet long, 2 feet wide, and 1½ feet thick, and weighs about 4 gross tons. The steel ingot is a special kind of casting to be subsequently rolled or forged.

Steel castings.—Any metal object which receives its shape from a mold, into which metal is poured while in a molten condition and there allowed to solidify, is a casting. Steel castings as distinguished from ingots are castings made of steel which are not subsequently forged or rolled.

Blooms and billets formed by rolling of ingots are names which, to some extent, are interchangeable, both being rectangular in cross section and square or nearly so. The term billet is more specifically applied to such products as have a cross section of from 4 to 36 square inches, the width never being equal to twice the thickness. The name blooms is similarly applied when the cross section is greater than 36 square inches.

Slabs are rectangular pieces where the width is equal to at least twice the thickness. From slabs, plates and sheets are rolled.

Out of ingots and blooms are rolled rails, heavy structural shapes, spliced bars, axle blocks, forged axles, and the like. Billets constitute the raw product of forgings and bars, the latter being manufactured into wire rods, wire, wire nails, bands, hoops, etc. Slabs

[1] Tiemann: Iron and steel, p. 318.

are transformed by rolling into plates, sheet bars, sheets and tin-plate, skelp and tubes, wheel blanks and forged wheels.

Ingots are not, as a general rule, commercial products in the United States. To a considerable extent the same can be said of blooms and slabs. Market quotations of these products are rarely seen. Billets, however, are bought and sold in large quantities, and their prices are regularly quoted in iron and steel publications.

DOMESTIC PRODUCTION.

The steel output of the United States is greater than that of any other country in the world. In 1918 this output amounted to over 44,000,000 long tons, and probably constituted between 40 and 50 per cent of the world's total production. In 1919 it was 34,671,232 gross tons.

Materials.—The ultimate raw material of steel ingots and castings is pig iron. Much scrap, however, is now used, and in the open-hearth process of steel manufacture 50 per cent and more of the furnace charge may consist of scrap. Blooms, billets, and slabs are simply ingots which have been modified by some rolling process. In the manufacture of ingots other important materials used are coal for fuel and ferromanganese or spiegeleisen, and often other ferro-alloys, both for purification and additions to the steel to give it certain desirable qualities. With reference to pig iron and coal, and to a considerable extent the ferro-alloys used, the United States is self-sufficient. For certain crucible and electric furnace steels used in the manufacture of high-grade tools and implements, pig iron from Sweden has been imported. Some ferro-alloys are imported, and before the war this country relied very largely upon foreign ferromanganese, ferrosilicon, ferrotungsten, and ferrochrome.

Equipment.—For steel used in the manufacture of rails, structural shapes, wire rods and ordinary steel wire, heavy plates, sheets, etc., the Bessemer or the open-hearth furnace is essential. For the more expensive steels crucible and electric furnaces are generally used. Certain preparatory mills called blooming, cogging, slabbing, and billet mills constitute equipment for the manufacture of blooms, slabs, and billets.

Process of manufacture.[2]—The steel of the world is now produced almost entirely by the Bessemer, open-hearth, crucible, electric, and cementation processes. The output of the first two of these processes represents the bulk of the world's product and is comparatively low in price.

(*a*) The *Bessemer process* for making steel consists in substance of blowing air through molten pig iron contained in a suitable vessel—the converter—whereby the impurities are oxidized and removed and the product is obtained in a fluid condition. Depending upon the nature of the lining of the vessel there are two modifications: (1) Acid-Bessemer process (the original process and hence often called simply Bessemer process), by which nearly all the silicon, carbon, and manganese are eliminated; and (2) basic-Bessemer process—the Thomas or Thomas-Gilchrist process—in which there is elimination of nearly all the silicon, carbon, and manganese, as in the acid process, and in addition, most of the phosphorus and part of the

[2] From Tiemann: Iron and Steel.

hur. In the United States the basic-Bessemer process is not
1. Pig iron containing more than 0.1 per cent of phosphorus is
suitable for the acid-Bessemer process; while a phosphorus con-
of 2½ per cent is desirable for the basic-Bessemer process.
) The *open-hearth process* (frequently spoken of as the Siemens
iemens-Martin process) consists in the oxidation and removal of
impurities contained in a bath of metallic iron lying on the hearth
regenerative furnace, the product being tapped in a fluid condi-
. As in the Bessemer process there are two modifications de-
ding upon the nature of the lining of the furnace: (1) Acid open-
rth process, which removes silicon, manganese, and carbon; and
basic open-hearth process, which in addition to these three ele-
nts, removes most of the phosphorus and often some of the sul-
r. One advantage which the open-hearth process has over the
semer is that a more uniform product can be secured, and it is
this reason that the open-hearth process is tending to supplant
Bessemer.
c) *The crucible process* for the production of steel consists of
ting down in closed crucibles various grades of iron or steel with
without the addition of carbon, ore, or other materials, the re-
ant product being cast in a fluid condition. As ordinarily prac-
d it is essentially a melting operation, there being little, if any,
ification, except perhaps as regards oxides or gases. The crucible
cess has a number of modifications.
d) The *electric process or processes* consist in the use of electricity
a source of heat necessary to cause the various reactions to take
ce (electrothermic). The furnaces used vary greatly, but may,
the whole, be classified under these four general heads: Induction
nace, resistance furnace, surface-resistance furnace, and arc fur-
e. The advantages of electric heating as compared with that
ained from the combustion of fuel are the following: (*a*) Higher
perature is available; (*b*) the possibility for greater purification
account of a slag high in lime which otherwise would be too in-
ible; (*c*) more complete exclusion of air and gases (except in the
e of the crucible process); (*d*) carbon is required only for reduc-
n (also for recarburization, if desired); and hence a smaller amount
mpurities is introduced than with ordinary fuel. The principal
dvantage of the electric process is the generally higher cost,
king it available only for the finer grades of steel (to replace that
de by the crucible process).
e) The *cementation process* (also called the converting process)
sists in impregnating bars of wrought iron or soft steel with car-
, at a temperature below its melting point, and is used (chiefly
England) for the production of high-carbon bars to be employed
the manufacture of crucible steel or shear steel. The bars are
ally of pure Swedish iron.
Organization.—The manufacture of steel requires a large outlay of
ital, and in the United States production is to a considerable
ent controlled by large consolidations, which have shown a ten-
cy not only in the direction of a horizontal expansion but also in
direction of a vertical growth. In other words, not only have
rks engaged in the manufacture of crude steel shown a tendency
combine, but successive stages in the production of steel, from the
ning of ore and coking coal to the manufacture of finished steel

shapes, have become integrated industries operating under a centralized control. In 1917 the United States Steel Corporation produced over 45 per cent of the country's total output of steel ingots and castings. In 1916 and 1919 it produced nearly 50 per cent.

Geographical distribution.—About two-thirds of the country's production of steel ingots and castings come from the States of Pennsylvania and Ohio. Other important States are Indiana, Illinois, New York, and Alabama. Large deposits of coal in these or neighboring States, great iron-ore reserves near furnaces or in the upper lakes region with cheap water transportation on the Great Lakes, and accessibility to the leading markets for steel in the world account for this geographical distribution.

History of the industry.—Steel was manufactured in limited quantities in the United States before the Civil War. It was not until after the Civil War, however, that the manufacture of steel became an important industry in this country. The introduction of the Bessemer process, coupled with a demand for steel for rails and other railway supplies, gave the industry its great start. Before the close of the nineteenth century the United States became the leading steel-producing country of the world. In 1861 Charles, William, and Frederick Siemens originated the open-hearth process (often called the Siemens or Siemens-Martin process), which since 1908 has been the principal method of producing steel in the United States. In 1916 and 1917 probably 40 to 50 per cent of the world's steel was produced in the United States.

The crucible process of steel manufacture has been carried on to some extent in this country from an early period, but there has been no growth comparable to that of the cheaper Bessemer and open-hearth processes. During the last couple of decades there has been some attempt to meet the demand for finer steels than can be made by the Bessemer and open-hearth methods by the introduction and development of the electric process.

Domestic production and consumption.—In 1917 the domestic production of steel ingots and castings amounted to 45,060,607 gross tons; in 1918, to 44,462,432 gross tons; and in 1919, to 34,671,232 gross tons. The largest output for any prewar year was that of 1913, when it aggregated 31,300,874 tons. Of the 1918 production, 43,051,022 tons consisted of steel ingots and 1,411,410 tons of steel castings. Of the total steel ingots and castings produced in 1918, 32,476,571 gross tons were basic open-hearth; 1,982,820 tons, acid open-hearth; 9,376,236 tons, Bessemer (acid); 115,112 tons, crucible; 511,364 tons, electric; and 329 tons, miscellaneous. Basic open-hearth has shown a marked tendency to gain at the expense of the Bessemer. The output of electric steel has increased enormously during the last four or five years, the output in 1913 being only 30,180 tons, and in 1914, 24,009 tons.

Owing to the way in which imports for consumption are compiled by the Bureau of Foreign and Domestic Commerce it is impossible to give precise figures regarding consumption. However, it can be said that nearly all the steel ingots, castings, blooms, billets, and slabs used in the United States or worked up into finished material is of domestic origin, and a relatively small proportion of the domestic production is ordinarily exported. In 1917 and 1918 exports were unusually large on account of war conditions. In the calendar year

ıey declined to 258,424 tons, or about 0.7 per cent of the ıc output.

rts.—Only a small proportion of the steel exported from the States goes in the form of ingots, blooms, and billets. From 1914, inclusive, exports ranged from 46,926 gross tons in 1914 381 gross tons in 1912. After the outbreak of hostilities in in 1914 exports increased, aggregating 1,970,831 gross tons, at $164,883,827, in 1918. In the years before the war con- ly over half of these exports went to England. After the k of war the exports to France, Italy, and Canada became rge, although England remained a very important market erican crude steel. As indicated above, exports declined after ıation of hostilities in November, 1918. In the calendar year ports aggregated 258,424 gross tons valued at $19,370,787.

FOREIGN PRODUCTION.

to the United States, Germany has been the leading country roduction of steel. In 1913 its output amounted to 18,959,000 tons.[3] During the war production declined, and in 1918 ed to 14,874,000 tons.[4] The output of the United Kingdom was 7,664,000 gross tons (excluding castings), and in 1918, 00 gross tons (including castings). In France in 1913 pro- amounted to 4,687,000 metric tons, but after the outbreak it declined greatly, aggregating only 1,912,000 tons in 1918. important countries producing steel are Russia, Canada, , and (before the war) Belgium. The Canadian output has ed greatly in recent years, amounting in 1918 and 1919 to 77 and 927,641 gross tons of ingots and castings, respectively. great bulk of the foreign steel, like that of the United States, mer and open-hearth. There is the same tendency shown in ited States for open-hearth steel to gain at the expense of the er. Crucible and electric steel is produced in the United m, in France, Germany, Sweden, and Canada. The cementa- ocess is also employed in England. These more expensive es often utilize Swedish iron.

IMPORTS.

ırt figures published by the Bureau of Foreign and Domestic rce include some forms of steel in a more advanced stage of cture than those embraced in this survey. Hence figures elow and in the statistical tables on imports by countries and umption must be taken as inclusive of articles other than those ed.

ng the years (fiscal) 1910 to 1918, inclusive, imports for con- on varied considerably in quantity and value, but in no year this period did they amount to more than 0.16 per cent of mestic production. In 1918 (fiscal year) they were 44,926 ns, valued at $3,799,026. Over 90 per cent of this importa- sisted of Bessemer and open-hearth steel. Imports of crucible nounted to 2,700 gross tons, the value of which, however, was 946, or about one-third of the total. In 1914 and 1915—before

on = 2,204.6 pounds.
g Luxemburg up to October, 1918. The returns for November and December, 1918, do not output of Luxemburg, the Saar district, and what was German Lorraine.

the war affected the iron and steel industry of the United State about one-fourth of the imported crude steel consisted of the prod manufactured by the more expensive processes, and the value of t material constituted about two-thirds that of the total impor supply.

The principal contributing countries before the war were Germa the United Kingdom, Sweden, and Belgium. In 1916, 1917, and 19 Canada and Sweden were the principal sources of imports. Engla and Sweden furnished much of the steel manufactured by the mo costly processes. In the calendar year 1919 Canada contribut almost all the imported Bessemer and open-hearth crude steel, a other crude steel came mainly from the United Kingdom.

PRICES.

The prices of steel ingots, blooms, and slabs are not ordinari quoted in trade journals. Producers of these articles usually can on the process of production to some later stage before making sale Steel billets, however, are an important commercial product, and the United States are quoted by the gross ton, generally with Pitt burgh as a base. During the years 1910 to 1915, inclusive, t monthly average price at Pittsburgh for Bessemer steel billets rang from $19 per gross ton in December, 1914, to $30.25 per gross ton December, 1915. In 1910 the highest monthly average was $27.5 (in January–March), and in 1913, $28.50 (in February and March During 1916 and 1917 war prices prevailed, reaching a maximum $100 per gross ton in July, 1917. During the period from Novembe 1917, to December, 1918, a maximum price of $47.50, fixed und governmental supervision, prevailed. In December, 1918, the pri fell slightly, and in September, 1919, steel billets were quoted at $38.5 per gross ton. Prices rose again to $62.50 in July, 1920, after whic they declined again, reaching $37 in April and May, 1921.

In England quotations were somewhat higher in 1913 and 191 than in the United States, soft steel billets in the Midlands distri averaging $26.78 per gross ton in the former year and $25.29 p gross ton in the latter. In 1916 the highest monthly average w $63.27 per gross ton. A price of $50.49 per gross ton fixed by th Government prevailed from November, 1916, to the close of 191 After Government restriction was taken off the price of billets bega to rise, reaching a monthly average of $73 per gross ton in Augus 1919. In April, 1921, the English price of soft-steel billets was $5 per gross ton.

TARIFF HISTORY.

Steel ingots, cogged ingots, blooms, slabs, and billets are me tioned in the tariff of 1883, in which an ad valorem duty of 45 p cent was imposed where the value was 4 cents per pound or less an specific rates named for steels of a higher value. In the law of 18 a similar graduation of rates depending on value was observed, t minimum rate being four-tenths cent per pound where the value the steel was 1 cent per pound or less. The tariff of 1894 reduc these rates about 25 per cent, and these new rates remained in effe under the act of 1897. In 1909 slight reductions were made on ste valued at 20 cents per pound or less and increased duties for t product valued above 20 cents. An ad valorem rate of 20 per ce was placed on steel valued at more than 40 cents per pound.

The tariff of 1913 distinguishes between steel made by the Bessemer, open-hearth, and similar processes, and steel produced by the crucible, electric, and cementation processes. Ingots, blooms, billets, etc., made by the former (alloys excluded) were placed on the free list, and on steel manufactured by the latter a duty of 15 per cent ad valorem was placed. A rate of 8 per cent ad valorem was imposed on steel castings made by the Bessemer, open-hearth, and similar processes.

In other steel producing countries steel ingots, blooms, billets, etc., are generally dutiable. In Canada rates range from $1.50 per ton under the British preferential tariff to $2.50 per ton plus 7½ per cent ad valorem under the general tariff. The French rates on crude steel in ingots vary from $0.394 per 100 pounds under the minimum tariff to $0.591 under the general tariff, and on steel rolled or forged in blooms, billets or bars, from $0.438 per 100 pounds under the minimum tariff to $0.657 per 100 pounds under the general tariff. The German general tariff has a rate of $0.162 per 100 pounds. These rates are quoted in American currency on the basis of the normal exchange equivalents.

COMPETITIVE CONDITIONS.

The principal factors in the competitive situation with reference to the manufacture of Bessemer and open-hearth steel ingots, blooms, and billets are the cost of pig iron, the price of fuel, and labor cost. Owing to the cheapness and accessibility of iron ore and coking coal the cost of producing pig iron in the United States is as low as in any part of the world. Pig iron and scrap have been found to make up from about 75 to 85 per cent of the total cost of manufacturing steel ingots, and steel ingots to constitute from 86 to 88 per cent of the total cost of producing large billets.[5] The price of bituminous coal used in steel manufacture is lower in the United States than in any other country in the world. While the rates of wages here are higher than in Europe the scale of operations and furnace and machine equipment are such as to make the output per man greater. Price quotations on steel billets at the present time (1921) are considerably higher in Europe than in the United States—those on soft steel billets, Midlands, England, were more than 40 per cent above the Pittsburgh quotations in April, 1921. [See price tables, infra.]

With reference to steel produced by processes other than the Bessemer and open hearth, other factors enter. The steel is produced on a much smaller scale and at greater expense. Much of the crucible steel is manufactured out of charcoal pig iron imported from Sweden. Electric steel is also manufactured out of high grade pig iron and scrap. An item of importance in the cost of production is the price of electric power. In so far as this power is generated with the use of coal the United States is at no disadvantage compared with other countries. Water power, however, is apparently more costly here than in countries like Canada, France, and Norway. It is noteworthy that the imports of crude steel manufactured by these more expensive processes form a much larger ratio to the country's output of this kind of steel than

[5] Based on Report of the Commissioner of Corporations on the Steel Industry, Part III, pp. 129-170. This report was published in 1913. While costs during the war have greatly increased there has been no radical change in the method of production and hence the items have probably remained proportionally the same. See infra for mill costs of manufacturing steel ingots and billets in the period from October, 1917, to December, 1918.

do the imports of the Bessemer and open-hearth steel, to the p duction of this cheaper product.

The Federal Trade Commission in the determination of costs iron and steel products during the war, for the use of the price-fix committee of the War Industries Board and of certain purchasi departments of the Government, obtained monthly cost sheets of t producing companies showing the average mill cost of produci open-hearth and Bessemer steel ingots and large and small bille from October, 1917, to December, 1918, inclusive. These cost she were for the mill costs and did not cover general and administrati expenses or general depreciation. At the request of the Tariff Co mission for information respecting the proportion of various items cost to the mill cost, the Federal Trade Commission compiled t costs as reported by five representative companies. They did n of course, include any items for interest or for income or excess-pro taxes. If the additional costs for general and administrative e penses and for general depreciation could be determined with acc racy, there would be a substantial addition to the mill cost as sho below.

These data have not as yet been published by the Federal Tra Commission and were furnished to the Tariff Commission with t statement that they were subject to revision. While these figu give the reported mill cost for only five companies, it is believed th they are sufficiently representative to show the relative importan of the particular items entering into the mill costs. For quarter periods these costs were as follows:

Average cost f. o. b. furnace of ingots, open-hearth and Bessemer combined, exclusiv general and administrative expense and depreciation of five representative companie quarters for the period October, 1917, to December, 1918.

[In dollars per gross ton.]

Items of cost.	1917	1918			
	October to September.	January to March.	April to June.	July to September.	Octobe Decem
Production—gross tons	6,587,436	5,138,275	6,436,590	6,455,417	6,50
Net metal	23.01	24.07	24.14	25.71	
Fuel	1.03	1.25	1.02	1.02	
Fluxes	.14	.17	.17	.22	
Labor	.93	1.02	1.03	1.15	
Maintenance and repairs	.68	.86	.79	.87	
Molds and stools	.32	.25	.23	.25	
Relining and renewals	.64	.67	.67	.72	
Other furnace costs	.82	.96	.82	.91	
Credits	(.01)	(.05)	(.06)	(.06)	
Furnace cost	27.56	29.20	28.81	30.79	
PER CENT OF FURNACE COST.					
Net metal	83.49	82.43	83.76	83.50	
Fuel	3.74	4.28	3.54	3.31	
Fluxes	.51	.58	.62	.71	
Labor	3.37	3.49	3.58	3.73	
Maintenance and repairs	2.47	2.95	2.75	2.83	
Molds and stools	1.16	.86	.78	.81	
Relining and renewals	2.32	2.29	2.30	2.34	
Other furnace costs	2.98	3.29	2.88	2.96	
Credits	(.04)	(.17)	(.21)	(.19)	
Furnace cost	100.00	100.00	100.00	100.00	

Average cost of large billets of five representative companies, by quarters, October, 1917, to December, 1918.

[In dollars per gross ton.]

Items of cost.	1917	1918			
	October to September.	January to March.	April to June.	July to September.	October to December.
Production—gross tons	1,757,857	1,299,282	1,862,259	1,860,716	1,924,720
Net metal	30.21	32.73	31.70	34.12	35.94
Fuel	.13	.14	.13	.16	.17
Labor	.62	.85	.94	1.09	1.20
Maintenance and repairs	.44	.44	.45	.55	.69
Rolls	.06	.11	.13	.13	.12
Steam and power	.41	.57	.44	.49	.52
Rebuilding and contingent	.01	.02	.02	.02	.02
Other mill costs	.46	.69	.60	.70	.75
Mill cost	32.34	35.55	34.41	37.26	39.41
PER CENT MILL COST.					
Net metal	93.41	92.07	92.12	91.57	91.20
Fuel	.40	.39	.38	.43	.43
Labor	1.92	2.39	2.73	2.93	3.04
Maintenance and repairs	1.36	1.24	1.31	1.48	1.75
Rolls	.19	.31	.38	.35	.31
Steam and power	1.27	1.60	1.28	1.31	1.32
Rebuilding and contingent	.03	.06	.06	.05	.05
Other mill costs	1.42	1.94	1.74	1.88	1.90
Mill cost	100.00	100.00	100.00	100.00	100.00

Average cost of small billets of five representative companies, by quarters, October, 1917, to December, 1918.

[In dollars per gross ton.]

Items of cost.	1917	1918			
	October to September.	January to March.	April to June.	July to September.	October to December.
Production—gross tons	647,553	676,934	609,126	544,934	576,449
Net metal	34.02	35.33	33.14	35.14	37.71
Fuel	.13	.14	.06	.02	.03
Labor	.57	.61	.57	.60	.69
Maintenance and repairs	.36	.36	.29	.35	.36
Rolls	.09	.09	.10	.16	.16
Steam	.46	.52	.39	.35	.35
Rebuilding and contingent	.03	.01	.01	.01	.01
Other costs	.32	.40	.38	.61	.70
Mill cost	35.98	37.46	34.94	37.24	40.01
PER CENT MILL COST.					
Net metal	94.55	94.31	94.85	94.36	94.25
Fuel	.36	.37	.17	.05	.07
Labor	1.59	1.63	1.63	1.61	1.72
Maintenance and repairs	1.00	.90	.83	.94	.90
Rolls	.25	.24	.28	.43	.40
Steam	1.28	1.39	1.12	.94	.88
Rebuilding and contingent	.08	.03	.03	.03	.03
Other costs	.89	1.07	1.09	1.64	1.75
	100.00	100.00	100.00	100.00	100.00

It will be observed that of the furnace cost of producing open-hearth and Bessemer steel ingots during the five quarters for which the above figures are tabulated the "net metal" item (pig iron and scrap) constituted over 80 per cent of the total. The next most important items were fuel and labor, which together made up between 7 and 8 per cent of the total, or approximately 40 per cent, of the conversion expense.

In the case of steel billets, both large and small, the "net metal" item for the same period constituted roughly between 91 and 95 per cent. Of the items entering into the conversion cost, labor was the most important, constituting, in the case of large billets in the last quarter of 1918, over 3 per cent of the total cost or about 35 per cent of the conversion cost. Other important items were maintenance and repairs and steam.

It will be seen that in the manufacture of crude steel by the Bessemer and open-hearth processes the cost of the raw material is by far the most important factor determining the competitive position of the producer, as this raw material is relatively very cheaply produced in the United States. The American manufacturer of open-hearth ingots and steel billets has little to fear from foreign competition.

TARIFF CONSIDERATIONS.

There is no particular tariff problem involved in the manufacture of steel ingots, blooms, billets, etc., by the Bessemer and open-hearth processes. In the year immediately preceding the outbreak of the World War the output in the United States exceeded that of Germany, the next leading producer, by more than 10,000,000 gross tons. During the war production in this country materially increased while that of Germany and other continental countries seriously declined.

The difference, already referred to, between steel manufactured by the Bessemer and open-hearth processes and steel produced by the more expensive methods, merits consideration in tariff treatment. The competitive situation in these two branches of steel manufacture is by no means the same for the reasons above given. Furthermore, the manufacture of steel by the electric process is comparatively new, and its possibilities are not at present determinable.

Attention should be called to an administrative difficulty in distinguishing between the two classes of steel named. It is often impossible at the present day to identify open-hearth and crucible steel even by microscopic laboratory analysis of the most expert nature. Formerly this could be done as open-hearth steel carried lower carbon, but the two steels are now frequently impossible to distinguish by analysis or structure. Hence this schedule can be administered in many cases only on makers' affidavits.

Production in United States—States.

All kinds of steel ingots and castings.

[Figures from Federal census.]

States.	1899		1904		1909	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
inois	1,460,710	$21,140,860	1,555,198	$32,742,473	2,671,087	.....
hio	1,812,829	36,276,162	2,529,997	42,949,759	4,713,869	.....
nnsylvania	6,431,297	131,052,363	7,733,640	144,774,781	12,206,608	.....
ew York	23,232	1,882,482	474,258	11,456,512	1,115,250	.....
ll other	956,932	22,187,008	1,377,499	29,308,451	2,816,385	.....
Total	10,685,000	212,538,875	13,670,592	261,231,976	23,523,199	$482,877,332

tates, 1914:

	Gross tons.
Illinois	1,770,753
Indiana	1,662,839
Ohio	5,451,508
Pennsylvania	11,851,400
All other	2,667,457
Total	23,403,957

All kinds of steel ingots.

[Figures from Federal census.]

States.	1899		1904		1909	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
Illinois	1,421,687	$18,480,093	1,499,160	$28,594,214	.....	.....
Ohio	1,794,427	34,847,424	2,492,401	40,462,006	.....	.....
Pennsylvania	6,361,586	125,254,061	7,618,833	136,680,399	.....	.....
All other	930,144	19,347,404	1,768,689	34,547,957	.....	.....
Total	10,507,844	197,928,982	13,379,083	240,284,576	22,973,964	$440,340,174

The total gross tons for 1914 were 22,815,266.

All kinds of steel castings.

[Figures from Federal census.]

States.	1899		1904		1909	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
inois and Indiana	45,213	$3,179,187	.....	.....	.....	.....
w Jersey and New York	21,517	2,365,701	47,261	$3,398,095	.....	.....
nnsylvania	69,711	5,798,302	114,807	8,094,382	.....	.....
nois	.....	.....	56,038	4,148,259	.....	.....
other	40,715	3,266,703	73,403	5,306,664	.....	.....
Total	177,156	14,609,893	291,509	20,947,400	549,235	$42,537,158

The gross tons for 1914 were 588,691.

Open-hearth steel ingots and castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Illinois	249,313	$6,026,723	361,650	$9,819,919	1,020,398
Ohio	114,926	3,459,900	480,844	9,868,067	1,383,725
Pennsylvania	2,437,918	53,639,364	4,230,657	83,008,316	9,295,439
All other	242,199	8,729,185	747,246	17,805,980	2,528,985
Total	3,044,356	71,855,172	5,820,397	120,502,282	14,228,777

States, 1914:	Gross tons.
Indiana	1,662,441
Ohio	2,591,062
Pennsylvania	9,754,323
All other	3,073,549
Total	17,081,375

Bessemer steel ingots and castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
California, Colorado, Illinois	1,340,421	$17,195,086			
Ohio	1,697,353	32,773,262	2,049,153	$33,081,092	3,327,859
Pennsylvania	3,911,127	71,197,603	3,442,312	57,273,697	2,849,112
California, Colorado, Illinois, Oregon			1,297,404	24,851,836	
Illinois					1,632,738
All other	583,127	10,948,033	980,046	19,435,040	1,370,404
Total	7,532,028	132,113,984	7,768,915	134,642,265	9,180,133

States, 1914:	Gross tons.
Illinois	867,804
Ohio	2,860,129
Pennsylvania	2,039,274
All other	452,097
Total	6,219,304

Production of steel ingots and castings, crucible, electric, and miscellaneous processes.

[Figures from Federal census.]

States.	1909, gross tons.	1914, gross tons.
Illinois	18,121	11,613
New York	15,934	21,301
Pennsylvania	62,037	57,603
All other	18,597	12,261
Total	114,689	103,278

Crucible steel ingots and castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Connecticut, New York	10,256	$949,395			
New Jersey	9,600	513,000	6,505	$476,255	
Pennsylvania	81,349	6,059,846	60,240	4,420,911	
Connecticut, Massachusetts, New York			11,075	839,995	
All other	3,188	251,089	2,239	221,411	
Total	104,393	7,773,330	80,059	5,958,572	100,263

The gross tons for 1914 were 81,685.

Production of steel ingots and castings by miscellaneous processes.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
New Jersey and Pennsylvania	4,223	$796,389	.....	.....	.....
Indiana and Pennsylvania	.....	.....	1,221	$128,857	.....
Not given	.....	.....	.....	.....	14,426
Total	4,223	796,389	1,221	128,857	14,426

The total gross tons for 1914 were 21,593.

Open-hearth steel ingots.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Illinois and Indiana	256,859	$4,352,997	378,433	$6,982,284	.....
Pennsylvania	2,369,742	48,088,052	4,117,204	75,118,890	.....
Ohio	96,824	2,049,162	443,248	7,380,314	.....
All other	155,402	4,360,370	609,511	12,280,981	.....
Total	2,878,827	58,850,581	5,548,396	101,762,469	13,725,783

The total gross tons for 1914 were 16,551,427.

Bessemer steel ingots.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
California, Colorado, and Illinois	1,339,738	$17,160,401	.....	.....	.....
Ohio	1,697,353	32,773,262	2,049,153	$33,081,692	.....
Pennsylvania	3,911,049	71,188,323	3,441,916	57,220,734	.....
California, Colorado, Illinois, and Oregon	.....	.....	1,296,333	24,804,149	.....
All other	580,127	10,669,533	967,086	17,845,061	.....
Total	7,528,267	131,791,519	7,754,488	132,951,636	9,180,133

The total gross tons for 1914 were 6,175,867.

Crucible steel ingots.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Connecticut and New York	8,582	$723,920	.....	.....	.....
New Jersey	9,600	513,000	5,595	$408,755	.....
Pennsylvania	80,795	5,977,686	59,713	4,340,775	.....
Connecticut, New York, and Massachusetts	.....	.....	10,885	819,741	.....
All other	1,773	72,276	6	1,200	.....
Total	100,750	7,286,882	76,199	5,570,471	90,242

The total gross tons for 1914 were 72,765.

Open-hearth steel castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Ohio	18,102	$1,410,738	37,596	$2,487,753	.....
Illinois and Indiana	44,407	3,115,563	64,016	4,626,238	.....
Pennsylvania	68,176	5,551,312	113,453	7,889,426	.....
All other	34,844	2,926,978	56,936	3,736,396	.....
Total	165,529	13,004,591	272,001	18,739,813	302,394

The total gross tons for 1914 were 529,948.

Bessemer steel castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Michigan, Minnesota, and Wisconsin	3,000	$278,500	4,295	$375,320	.....
Ohio	761	43,965	7,488	1,185,228	.....
All other			2,644	130,075	.....
Total	3,761	322,465	14,427	1,690,623	34,[illegible]

The total gross tons for 1914 were 43,437.

Crucible steel castings.

[Figures from Federal census.]

States.	1899		1904		1909, gross tons.
	Gross tons.	Value.	Gross tons.	Value.	
Connecticut and New York	1,674	$225,475	.....	.....	.....
Indiana, Illinois, and Wisconsin	1,086	157,924	.....	.....	.....
Indiana, Illinois, Ohio, Tennessee, and Wisconsin	.....	.....	2,233	$220,211	.....
All other	883	103,049	1,627	167,890	.....
Total	3,643	486,448	3,860	388,101	10,021

The total gross tons for 1914 were 8,920.

Steel ingots and castings, all kinds, gross tons.

[Figures from annual statistical reports of the American Iron and Steel Institute.]

States.	1910	1911	1912
Pennsylvania	13,207,539	11,990,523	15,633,754
Ohio	5,050,608	4,994,110	6,856,020
All other	7,836,772	6,691,473	8,761,529
Total	26,094,919	23,676,106	31,251,303

States.	1913	1914	1915
New York	1,235,704	759,355	1,292,035
Pennsylvania	15,554,294	11,924,776	15,832,509
Georgia, Alabama, and North Carolina	823,994	572,073	788,304
Ohio	6,755,051	5,458,383	7,451,652
Indiana	2,181,958	1,630,720	2,506,027
Illinois	2,759,026	1,779,929	2,467,370
All other	1,990,847	1,387,794	1,809,2[illegible]
Total	31,300,874	23,513,030	32,151,[illegible]

Steel ingots and castings, all kinds, gross tons.

[Figures from annual statistical report of the American Iron and Steel Institute.]

States.	1916	1917	1918	1919
.....	1,832,477	2,045,210	2,204,971	1,241,103
.....	19,597,181	19,998,154	19,067,369	15,676,950
Maryland.....	556,897	598,876	506,642	411,913
ma, and North Carolina.....	558,160	552,249	476,607	328,664
.....	1,186,099	1,292,247	1,151,821	1,106,525
.....	9,784,409	10,373,407	10,718,471	8,255,657
.....	3,245,599	3,725,522	3,915,399	3,129,884
.....	3,827,098	3,792,135	3,654,794	2,628,085
hington, and Oklahoma.....	364,937	575,889	591,527	305,154
.....	631,979	663,987	615,527	428,184
.....	1,188,844	1,442,931	1,559,304	1,159,113
.....	42,773,680	45,060,607	44,462,432	34,671,232

Open-hearth steel ingots and castings, gross tons.

[Figures from annual statistical report of the American Iron and Steel Institute.]

States.	1910	1911	1912
.....	223,158	189,879	214,325
New Jersey.....	713,245	679,152	792,201
yland, and District of Columbia.....	10,153,816	9,594,914	12,408,109
Kentucky, Georgia, Alabama, and Tennessee.....	158,827	128,309	44,079
.....	738,392	636,625	967,357
.....	1,733,409	1,721,549	2,565,343
.....	1,307,129	1,394,520	2,001,937
Wisconsin.....	995,011	801,624	1,235,166
.....	38,638	27,993	41,827
.....	442,884	424,085	510,179
.....	16,504,509	15,598,650	20,780,723

States.	1913	1914	1915
.....	195,419	137,962	191,582
New Jersey.....	996,312	719,227	1,266,017
yland, and District of Columbia.....	12,522,227	9,854,038	13,245,393
Kentucky, Georgia, Alabama, and Tennessee.....	186,961	125,760	227,982
.....	997,016	723,097	967,720
.....	2,726,219	2,592,778	3,521,404
.....	2,180,106	1,628,840	2,504,427
Wisconsin.....	1,264,854	896,610	1,169,657
.....	44,173	24,314	35,085
.....	486,644	472,058	549,835
.....	21,599,931	17,174,684	23,679,102

States.	1916	1917	1918	1919
.....	278,768	332,597	329,630	286,826
New Jersey.....	1,872,258	2,110,846	2,245,239	1,296,005
yland, and District of Columbia.....	16,030,251	16,284,102	15,574,101	12,692,112
Kentucky, Georgia, Alabama, and	481,574	514,457	327,834	401,494
.....	1,429,867	1,616,952	1,548,253	1,426,771
.....	5,057,751	6,074,857	6,729,955	5,112,616
.....	3,243,961	3,722,931	3,910,899	3,122,486
.....	1,812,169	1,966,296	2,283,991	1,664,993
Wisconsin.....	61,140	67,211	67,051	41,067
.....	1,147,688	1,458,644	1,442,438	904,324
.....	31,415,427	34,148,893	34,459,391	26,948,694

Bessemer steel ingots and castings, gross tons.

[Figures from Annual Statistical Report of the American Iron and Steel Institute.]

States.	1910	1911	1912	1913	1914
Ohio	3,314,053	3,268,994	4,285,673	4,024,662	2,882,709
Pennsylvania	2,975,750	2,338,813	3,157,928	2,954,818	2,014,526
Illinois	1,693,053	1,335,053	1,559,576	1,475,274	871,119
All other	1,429,916	1,004,994	1,324,724	1,090,952	672,510
Total	9,412,772	7,947,854	10,327,901	9,545,706	6,220,864

States.	1915	1916	1917	1918	1919
Ohio	3,929,665	4,711,784	4,256,337	3,920,442	3,073,941
Pennsylvania	2,507,243	3,444,163	3,537,094	3,281,941	2,851,402
Illinois	1,270,502	1,958,259	1,763,052	1,229,568	906,331
All other	579,803	944,833	923,477	944,285	439,886
Total	8,287,213	11,059,039	10,479,960	9,376,236	7,271,562

Production in Principal Foreign Countries.[1]

Steel ingots and castings, in tons.[2]

Countries.	1910	1911	1912	1913	1914	1915
United Kingdom [3]	6,374,000	6,462,000	6,796,000	7,664,000	7,835,000	[4] 8,530,000
Germany	13,699,000	15,019,000	17,302,000	18,959,000	14,973,000	13,258,000
France	3,390,000	3,681,000	4,428,000	4,687,000	[5]	[5]
Russia	3,479,000	3,870,000	4,498,000	4,827,000	[5]	4,018,000
Austria-Hungary	2,188,371	2,363,008	2,785,105	2,682,619	2,190,759	2,686,226
Belgium	1,449,500	2,192,630	2,515,040	[5]	[5]	[5]
Canada	745,971	800,504	868,811	1,060,503	751,738	928,157
Italy	635,000	736,000	801,951	[4] 911,500	[5]	[5]
Sweden	468,600	456,500	508,300	582,700	500,600	588,800
Spain	316,301	322,981	317,880	365,118	[5]	[5]
Japan		10,222	12,451	13,728	15,386	16,768

Countries.	1916	1917	1918	1919 [7]	
				Quantity.	Value.
				Metric tons.	
United Kingdom [3]	[4] 9,196,000	[4] 9,804,000	[4] 9,591,000	8,021,093	
Germany	16,183,000	16,587,000	[6] 14,874,000	[5]	
France	1,952,000	2,232,000	1,912,000	2,186,260	
Russia	4,696,000	3,000,000	[5]	[5]	
Austria-Hungary	3,336,607	2,927,789	1,763,745	[5]	
Belgium	99,371	9,530	10,340	[5]	
Canada	1,295,707	1,583,786	1,609,886	935,609	
Italy	1,269,486	1,331,641	992,523	[5]	
Sweden	717,600	681,700	521,800	469,300	
Spain	322,931	470,241	303,206	[5]	
Japan	23,861	[5]	[5]	[5]	

[1] Figures for the United Kingdom, Germany, and France for the years 1910–1918 are taken from the Economist, May 31, 1919, p. 997. Other figures from The Mineral Industry during 1919, p. 366.
[2] Gross tons for United Kingdom and metric tons for Germany, France, and other countries.
[3] Steel castings not included until 1915. Steel castings are included during years 1915–1918.
[4] Including steel castings.
[5] No returns.
[6] Including Luxemburg up to October, 1918. Returns for November and December do not include the production of Luxemburg, Saar district, and Lorraine.
[7] Mineral Industry, 1919, p. 366.

IMPORTS BY COUNTRIES.

...gots, blooms, slabs, billets, and bars of steel and steel in forms, n. e. s.

[Fiscal years.]

...d from—	1910		1911		1912	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
...gary	1,483,802	$231,937	1,640,783	$187,342	2,214,099	$214,035
	25,269,357	254,407	36,599,827	402,187	10,530,504	119,973
	788,873	103,733	132,210	15,060	234,231	17,402
	32,520,928	582,885	17,332,280	418,389	15,457,255	433,571
	127,423	1,894	1,480,681	16,638		
	3,415,696	118,887	6,854,922	198,983	6,335,882	191,371
	5,871	1,290	133,326	9,820	168,806	14,531
...gdom	19,595,745	2,357,419	21,412,044	2,212,432	15,246,126	1,481,619
	177,064	11,750	113,968	18,477	43,318	6,277
					111,061	1,098
	4,022	205	16,437	1,435	25,232	1,811
	83,388,781	3,664,407	85,716,478	3,480,763	50,367,144	2,481,688

Imported from—	1913		1914[1]	
	Pounds.	Value.	Pounds.	Value.
...gary	2,219,340	$234,958	294,953	$38,944
	862,544	11,780	1,981,864	24,445
	177,430	5,957	12,817	849
	9,078,363	517,664	4,752,504	137,185
			511	17
	13,252,921	438,557	2,907,500	105,138
	194,778	16,281	1,970	271
...gdom	20,680,286	2,292,439	4,125,388	464,853
	238,329	20,983	63,510	1,579
	43,300	3,699	9,460	1,421
	46,747,291	3,542,318	14,150,507	774,702

...over only that part of the fiscal year beginning with July 1, 1913, and ending Oct. 3, 1913.

...ooms, billets, and bars of steel and steel in forms, n. e. s., made by the Bessemer, open-hearth, or similar processes, not containing alloys.

[Fiscal years.]

...rted from—	1914[1]		1915		1916	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
	67,094	$554				
	3,544,122	32,396	866,938	$9,851		
					30,663	$1,004
	6,753	208	1,122	34		
	1,472,315	26,287	437,449	10,462	2,742,715	104,865
...gdom	2,669,273	41,556	2,683,471	49,920	667,378	29,813
					21,926,590	314,832
...gary	1,553	72				
	7,761,110	101,073	3,988,980	70,267	25,367,346	450,514

Imported from—	1917		1918	
	Pounds.	Value.	Pounds.	Value.
	2,137,413	$132,650	1,155,204	$91,106
	42,069	2,231		
	35,719,363	572,976	79,721,061	1,611,622
			52,337	1,701
...d			3,875	387
	37,898,845	707,857	80,932,477	1,704,816

...or 1914 cover part of fiscal year beginning Oct. 4, 1913, and ending June 30, 1914.

Steel ingots, blooms, blanks, and billets. Made by the Bessemer, open-hearth, or similar process, not containing alloys.

[Calendar years.]

Imported from—	1918		1919	
	Pounds.	Value.	Pounds.	Value.
Sweden	436,407	$35,841		
England			140,668	$9,422
Canada	74,850,874	1,513,857	18,294,962	451,048
Mexico				
New England	3,875	387		
Chile	400	90		
Total	75,291,556	1,550,175	18,435,630	460,470

Ingots, blooms, slabs, billets, and bars of steel, and steel in forms, n. e. s. Made by process other than the Bessemer, open-hearth, or similar processes, whether containing alloys or not.

[Fiscal years.]

Imported from—	1914 [1]		1915		1916	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Austria-Hungary	762,220	$132,580	332,708	$29,929		
Belgium	15,689,179	164,452	12,898,495	124,896		
Denmark			5,418	275		
France	35,151	3,293	607,103	7,191		
Germany	19,861,865	366,703	15,272,875	201,749	2,466	$61
Italy	1,246	13	174	14		
Netherlands			59,532	4,426	50,985	1,99
Norway	4,620	363			500	13
Sweden	8,806,315	325,341	8,642,855	435,062	11,186,817	688,57
Switzerland	22,028	1,851	13,049	2,913		
United Kingdom:						
England	16,466,351	1,395,414	12,576,821	1,233,393	11,557,870	1,401,78
Scotland	525,173	6,963	418,814	6,615	3,074	66
Canada	147,945	19,466	163,435	28,668	5,466,223	189,99
Mexico					110	7
Cuba					23,913	3,35
Total	62,322,093	2,416,442	50,991,279	2,075,131	28,291,958	2,329,56

Imported from—	1917		1918	
	Pounds.	Value.	Pounds.	Value.
Denmark	5,945	$542		
France	149	445		
Germany			39,778	$149
Italy	100	15		
Netherlands	58,801	5,401	8,000	2,500
Sweden	8,219,431	813,296	4,285,666	655,797
United Kingdom:				
England	8,287,072	1,194,194	5,542,587	1,078,289
Scotland	506	82	16,601	3,282
Canada	8,177,594	305,802	8,261,257	427,317
Mexico	102,648	3,129	3,156,124	105,413
Argentina	3,258	2,249		
Total	24,855,504	2,325,155	21,309,973	2,271,038

[1] Figures for 1914 cover part of the year beginning Oct. 4, 1913, and ending June 30, 1914.

teel ingots, blooms, slabs, billets, etc, made by the crucible, electric, or cementation process.

[Calendar years.]

Imported from—	1918		1919	
	Pounds.	Value.	Pounds.	Value.
ance	3,298	$2,394		
rway			45,931	$28,057
eden	1,464,106	293,522	1,809,446	1,181,956
ited Kingdom	2,582,513	795,073	4,252,243	1,552,802
nada	108,129	19,514	92,812	33,110
Total	4,158,046	1,110,503	6,200,432	2,795,925

Imports for Consumption—Revenue.

Steel ingots, cogged ingots, blooms, and slabs, by whatever process made; die blocks or blanks; billets and bars and tapered or beveled bars; mill shafting; pressed, sheared, or stamped shapes; hammer molds or swaged steel; gun-barrel molds not in bars; alloys used as substitutes for steel in the manufacture of tools; all descriptions and shapes of dry sand, loam, or iron-molded steel castings; and steel in all forms and shapes not specially provided for—valued at 1 cent per pound or less, to valued above 16 cents per pound.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1907	3/10 cent per pound to 4 7/10 cents per pound.	41,323,302	$3,038,541	$602,650	$0.073	19.83
1908	do	35,510,433	2,103,812	440,221	.059	20.93
1909	do	25,834,040	1,841,646	373,920	.069	20.30

Steel ingots, cogged ingots, blooms, and slabs, by whatever process made; die blocks or blanks; billets and bars and tapered or beveled bars; mill shafting; pressed, sheared, or stamped shapes not advanced in value or condition by any process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun-barrel molds not in bars; alloys used as substitutes for steel in the manufacture of tools; all descriptions and shapes of dry sand, loam, or iron-molded steel castings not specially provided for—valued at ¾ cent per pound or less, to valued above 40 cents per pound.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1910	7/40 cent per pound to 7 cents per pound; 20 per cent ad valorem when valued above 40 cents per pound.	85,012,934	$3,672,729	$799,414	$0.043	21.77
1911	do	80,149,518	3,368,274	736,096	.042	21.85
1912	do	48,139,399	2,448,990	538,341	.051	21.98
1913	do	43,543,195	3,434,982	736,353	.079	21.40
1913	D. R. Pan. Act	345,924	6,274		.018	
1914 [1]	7/40 cent per pound to 7 cents per pound; 20 per cent ad valorem when valued above 40 cents per pound.	11,449,236	654,825	138,114	0.057	21.09
1914	For use of the United States; free.	26,052	266		.010	

[1] From July 1, 1913, to Oct. 3, 1913, inclusive.

Steel ingots, cogged ingots, blooms, and slabs; die blocks or blanks; billets and bars and tapered or beveled bars; pressed, sheared, or stamped shapes, not advanced in value or condition by any process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun-barrel molds not in bars; alloys used as substitutes for steel in the manufacture of tools; all descriptions and shapes of dry sand, loam, or iron-molded steel castings; and steel, n. s. p. f., if made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	15 per cent	15,651,380	$1,765,635	$264,845	$0.113	15.00
1914	For use of the United States; free.	11,322	148		.013	
1915	15 per cent	13,157,192	1,410,712	211,606	.107	15.00
1916	do	11,604,969	1,624,248	243,637	.140	15.00
1917	do	9,285,740	1,426,423	213,963	.154	15.00
1918	do	6,048,579	1,271,946	190,791	.210	15.00
1918 [2]	do	6,028,383	1,489,695	223,454	.247	15.00
1919 [2]	do	3,318,726	1,566,025	234,904	.472	15.00

[1] From Oct. 4, 1913. [2] Calendar year.

Steel ingots, cogged ingots, blooms and slabs, die blocks, or blanks and billets, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	Free	6,284,640	$82,775		$0.013	
1915	do	2,438,599	44,871		.018	
1916	do	25,293,020	449,117		.018	
1917	do	37,898,845	707,857		.019	
1918	do	80,928,602	1,704,429		.021	
1918 [2]	do	75,287,681	1,549,788		.021	
1919 [2]	do	18,435,630	440,470		.024	

[1] From Oct. 4, 1913. [2] Calendar year.

Steel bars and tapered or beveled bars; mill shafting; pressed, sheared, or stamped shapes, not advanced in value or condition by any process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun-barrel molds not in bars; all descriptions and shapes of dry sand, loam, or iron-molded steel castings, if made by the Bessemer, Siemens-Martin, open-hearth, or similar process not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	8 per cent	48,307,496	$814,778	$65,182	$0.017	8.00
1915	do	39,943,425	714,590	57,167	.018	8.00
1916	do	18,353,080	721,012	57,680	.039	8.00
1916	Reciprocity treaty with Cuba, 8 per cent less 20 per cent.	23,913	3,587	229	.150	6.40
1917	8 per cent	15,365,018	831,764	66,541	.054	8.00
1918	do	13,656,562	822,651	65,812	.060	8.00
1918 [2]	do	9,829,641	468,451	37,476	.048	8.00
1919 [2]	do	11,627,086	572,268	45,781	.049	8.00

[1] From Oct. 4, 1913. [2] Calendar year.

Domestic Exports.

Billets, ingots, and blooms of steel.

[FISCAL YEARS.]

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
ium	650	$14,967				
					50	$1,200
ed Kingdom:						
England	35,191	803,258	133,548	$2,928,147	175,580	3,839,031
Scotland	1,483	33,373	2,553	55,729	4,606	100,068
ada	12,853	306,268	50,387	1,113,957	53,579	1,200,710
nduras			27	818		
ama	1,377	34,699	25	921		
ico					5	120
a					1	21
tralia and Tasmania					533	12,466
Zealand					27	605
Total	51,554	1,192,565	186,540	4,099,572	234,381	5,154,221

Exported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
ance					2,588	$51,165
ited Kingdom:						
England	148,535	$3,385,584	25,053	$549,885	177,063	3,821,775
Scotland	3,502	80,135	227	5,880	20,492	450,024
Ireland					1,364	36,822
ada	78,543	1,865,120	21,646	487,089	16,452	394,946
nduras					3	53
ama					276	6,175
ico	38	880				
a					66	2,705
an	110	3,309			32	4,210
tralia					2,080	44,358
Total	230,728	5,335,028	46,926	1,042,854	220,416	4,815,233

Exported to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*		*Gross tons.*	
rance	576,109	$30,079,143	829,486	$57,954,191	681,076	$57,248,716
ibraltar			2,303	207,270		
aly	49,984	1,857,420	370,745	22,970,089	317,101	27,540,150
ussia-Europe			1,190	85,509		
pain	6	150	1,209	108,810	2,896	148,350
nited Kingdom:						
England	216,845	5,924,919	500,401	37,398,829	782,771	64,770,702
Scotland	23,906	692,214	37,901	2,795,636	58,785	4,887,691
Ireland	51	1,173	2,653	210,389	4,042	363,973
anada	92,597	3,733,393	186,272	14,098,429	116,677	9,242,036
apan	554	27,734	303	19,880	2,587	224,102
ll other	2,045	93,558	2,563	246,491	4,896	458,107
Total	962,097	42,409,704	1,935,026	136,095,523	1,970,831	164,883,827

Billets, ingots, and blooms of steel—Continued.

CALENDAR YEARS.

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
France	680,248	$57,772,664	77,275	$7,008,496
Italy	209,860	20,072,640	50,524	3,773,217
England	603,144	49,015,578	88,640	6,011,035
Scotland	40,628	3,463,609	16,392	887,200
Ireland	3,343	299,297	42	3,208
Canada	247,332	19,787,779	10,225	535,665
Mexico	10	1,369	169	11,516
Cuba	967	86,320	38	4,087
Chile	11	1,331	3	199
Straits Settlements	24	2,375	.....	.....
All other	622	65,189	15,115	1,134,173
Total	1,786,189	150,568,151	258,424	19,370,787

PRICES.

Bessemer steel billets.

PER GROSS TON, PITTSBURGH, PA.

[Date from Iron Age, Jan. 6, 1921.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
January	$27.50	$23.00	$20.00	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50	$48.00
February	27.50	23.00	20.00	28.50	21.00	19.50	33.50	65.00	47.50	43.50	55.25
March	27.50	23.00	19.75	28.50	21.00	19.70	42.40	66.25	47.50	42.25	60.00
April	26.75	23.00	20.00	28.50	20.80	20.00	45.00	73.75	47.50	38.50	60.00
May	26.12	22.60	20.80	27.60	20.00	20.00	45.00	86.00	47.50	38.50	60.00
June	25.30	21.00	20.87	26.50	19.50	20.50	43.50	98.75	47.50	38.50	61.00
July	25.00	21.00	21.50	26.60	19.00	21.38	41.00	100.00	47.50	38.50	62.50
August	24.62	21.00	22.12	26.00	20.25	23.13	44.20	80.00	47.50	38.50	61.00
September	24.40	20.75	23.62	24.87	21.00	24.10	45.00	66.25	47.50	38.50	58.74
October	23.75	20.00	26.00	23.30	20.00	24.63	46.25	49.38	47.50	38.50	55.00
November	23.30	19.50	27.00	21.00	19.25	26.50	52.00	47.50	47.50	38.87	49.70
December	23.00	19.25	27.00	20.00	19.00	30.25	57.50	47.50	45.50	46.00	43.50
Annual average	25.40	21.43	22.39	25.81	20.08	22.41	43.95	70.78	47.33	40.30	46.22
Highest monthly average	27.50	23.00	27.00	28.50	21.00	30.25	57.50	100.00	47.50	46.00	62.50
Lowest monthly average	23.00	19.25	19.75	20.00	19.00	19.25	32.00	47.50	45.50	38.50	43.50
Government price	.....	.....	.....	.....	.....	.....	.....	47.50	47.50	.....	.....

Soft steel billets.

PER GROSS TON, MIDLANDS, ENGLAND.

Data from Iron and Coal Trades Review, London. Price reduced to dollars and cents from pounds, shillings, and pence.]

Month.	1913	1914	1915	1916	1917	1918	1919
January	$29.81	$23.42	$29.35	$58.15	$50.49	$50.49	$51.71
February	29.81	23.42	31.79	60.83	50.49	50.49	58.10
March	29.81	23.42	34.67	60.83	50.49	50.49	59.62
April	28.50	23.42	35.71	53.23	50.49	50.49	59.62
May	28.29	23.30	36.20	60.60	50.49	50.49	70.56
June	27.22	23.12	37.11	63.27	50.49	50.49	69.80
July	27.07	23.12	37.11	62.28	50.49	50.49	68.53
August	24.82	28.36	37.11	59.31	50.49	50.49	73.00
September	24.64	28.59	37.11	59.31	50.49	50.49	73.00
October	24.33	28.59	38.51	59.31	50.49	51.86	73.00
November	23.72	27.88	48.67	50.49	50.49	50.49	75.43
December	23.42	26.89	54.05	50.49	50.49	50.49	79.54
Annual average	26.78	25.29	38.12	58.18	50.49	50.60	67.66
Highest monthly average	29.81	28.59	54.05	63.27	50.49	51.86	79.54
Lowest monthly average	23.42	23.12	29.35	50.49	50.49	50.49	51.71
Government price	.....	.....	.....	50.49	50.49	50.49	.....

Rates of Duty.

...el ingots, cogged ingots, blooms, and slabs, by whatever process made; die blocks or ...blanks; billets, etc., and steel in all forms and shapes not specially provided for in this ...act.

...t of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
...3....	177	Valued at 4 cents per pound or less	45 per cent.
		Above 4 cents per pound and not above 7 cents per pound	2 cents per pound.
		Above 7 cents and not above 10 cents per pound	2¾ cents per pound.
		Above 10 cents per pound	3½ cents per pound.
...0....	146	Valued at 1 cent per pound or less	$\frac{7}{10}$ cent per pound.
		Above 1 cent and not above $1\frac{4}{10}$ cents per pound	$\frac{8}{10}$ cent per pound.
		Above $1\frac{4}{10}$ cents and not above $1\frac{8}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $1\frac{8}{10}$ cents and not above $2\frac{2}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $2\frac{2}{10}$ cents and not above 3 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 3 cents and not above 4 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 4 cents and not above 7 cents per pound	2 cents per pound.
		Above 7 cents and not above 10 cents per pound	$2\frac{2}{10}$ cents per pound
		Above 10 cents and not above 13 cents per pound	$3\frac{1}{2}$ cents per pound.
		Above 13 cents and not above 16 cents per pound	$4\frac{2}{10}$ cents per pound.
		Above 16 cents per pound	7 cents per pound.
...4....	122	Valued at 1 cent per pound or less	$\frac{8}{10}$ cent per pound.
		Above 1 cent and not above $1\frac{4}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $1\frac{4}{10}$ cents and not above $1\frac{8}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $1\frac{8}{10}$ cents and not above $2\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Above $2\frac{2}{10}$ cents and not above 3 cents per pound	$\frac{2}{10}$ cent per pound.
		Above 3 cents and not above 4 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 4 cents and not above 7 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 7 cents and not above 10 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 10 cents and not above 13 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 13 cents and not above 16 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 16 cents per pound	$4\frac{2}{10}$ cents per pound.
...7....	135	Valued at 1 cent per pound or less	$\frac{7}{10}$ cent per pound.
		Above 1 cent and not above $1\frac{4}{10}$ cents per pound	$\frac{8}{10}$ cent per pound.
		Above $1\frac{4}{10}$ cents and not above $1\frac{8}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $1\frac{8}{10}$ cents and not above $2\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Above $2\frac{2}{10}$ cents and not above 3 cents per pound	$\frac{2}{10}$ cent per pound.
		Above 3 cents and not above 4 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 4 cents and not above 7 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 7 cents and not above 10 cents per pound	2 cents per pound.
		Above 10 cents and not above 13 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 13 cents and not above 16 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 16 cents per pound	$4\frac{2}{10}$ cents per pound.
...9....	131	Valued at ¾ cent per pound or less	$\frac{7}{10}$ cent per pound.
		Above ¾ cent and not above $1\frac{4}{10}$ cents per pound	$\frac{8}{10}$ cent per pound.
		Above $1\frac{4}{10}$ cents and not above $1\frac{8}{10}$ cents per pound	$\frac{9}{10}$ cent per pound.
		Above $1\frac{8}{10}$ cents and not above $2\frac{2}{10}$ cents per pound	$\frac{1}{10}$ cent per pound.
		Above $2\frac{2}{10}$ cents and not above 3 cents per pound	$\frac{2}{10}$ cent per pound.
		Above 3 cents and not above 4 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 4 cents and not above 7 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 7 cents and not above 10 cents per pound	$1\frac{2}{10}$ cents per pound.
		Above 10 cents and not above 13 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 13 cents and not above 16 cents per pound	$2\frac{2}{10}$ cents per pound.
		Above 16 cents and not above 24 cents per pound	$4\frac{2}{10}$ cents per pound.
		Above 24 cents and not above 32 cents per pound	6 cents per pound.
		Above 32 cents and not above 40 cents per pound	7 cents per pound.
		Above 40 cents per pound	20 per cent.
...3....	110	* * * All descriptions and shapes of dry sand, loam, or iron molded steel castings; all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	8 per cent ad valorem.
		Steel ingots, cogged ingots, blooms, and slabs, die blocks or blanks; billets, * * * and steel not specially provided for in this section, all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys.	15 per cent ad valorem.
...913....	613	Steel ingots, cogged ingots, blooms, and slabs, die blocks or blanks, and billets, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys.	Free.

MISCELLANEOUS.

Production of steel ingots and castings, by processes, 1903 and 1913-1919 (in gross tons).

Years.	Open-hearth.			Bessemer.	Crucible.	Electric.	Miscellaneous.	Total.
	Basic.	Acid.	Total.					
1903	4,734,913	1,094,998	5,829,911	8,592,829	102,434	.....	9,804	14,534,978
1913	20,344,626	1,255,305	21,599,931	9,545,706	121,226	30,180	3,831	31,300,874
1914	16,271,129	903,555	17,174,684	6,220,846	89,869	24,009	3,622	23,513,030
1915	22,308,725	1,370,377	23,679,102	8,287,213	113,782	69,412	1,527	32,151,036
1916	[1] 29,616,658	1,798,769	31,415,427	11,059,039	129,692	168,918	604	42,773,680
1917	[1] 32,087,507	2,061,386	34,148,893	10,479,960	126,716	304,543	495	45,060,607
1918	[1] 32,476,571	1,982,820	34,459,391	9,376,236	115,112	511,364	329	44,462,434
1919	[1] 25,719,312	1,229,382	26,948,694	7,271,562	63,572	384,452	2,952	34,671,222

[1] Including, in 1916, 3,436,457 tons of duplex steel ingots and castings; in 1917, 3,791,830 tons of duplex steel ingots and castings; in 1918, 3,870,017 tons of duplex steel ingots and castings; and in 1919, 2,819,765 tons of duplex steel ingots and castings.

Production of steel ingots, 1903 and 1913-1919 (in gross tons).

Years.	Open-hearth.			Bessemer.	Crucible.	Electric.	Miscellaneous.	Total.
	Basic.	Acid.	Total.					
1903	4,600,034	829,529	5,429,563	8,574,730	97,025	.....	3,395	14,104,713
1913	19,884,465	805,250	20,689,715	9,465,200	103,655	20,973	587	30,280,130
1914	15,936,985	633,382	16,570,367	6,154,964	78,683	15,458	312	22,819,784
1915	21,975,622	968,148	22,943,770	8,194,737	99,026	46,348	331	31,284,212
1916	29,011,146	1,227,832	30,238,978	10,916,248	120,341	126,048	302	41,401,917
1917	31,528,939	1,406,798	32,935,737	10,320,688	122,882	239,632	261	43,619,200
1918	31,970,691	1,347,870	33,318,561	9,215,392	113,782	403,068	219	43,051,022
1919	25,405,347	780,827	26,186,174	7,172,743	62,563	272,942	373	33,694,795

Percentage of production of steel by processes, 1916-1919.

Processes.	1916			1917			1918			1919		
	Ingots.	Per cent castings.	Total.	Ingots.	Per cent castings.	Total.	Ingots.	Per cent castings.	Total.	Ingots.	Per cent castings.	Total.
Open-hearth	73.0	85.8	73.4	75.5	84.2	75.8	77.4	80.8	77.5	77.7	78.1	77.7
Bessemer	26.4	10.4	25.9	23.7	11.0	23.3	21.4	11.4	21.1	21.3	10.1	21.0
Crucible and all other	.6	3.8	.7	.8	4.8	.9	1.2	7.8	1.4	1.0	11.8	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Acid open-hearth	2.9	41.6	4.2	3.2	45.4	4.6	3.1	45.0	4.5	2.3	45.9	3.5
Basic open-hearth	70.1	44.2	69.2	72.3	38.8	71.2	74.3	35.8	73.0	75.4	32.2	74.2

Production of steel castings, 1903, 1913-1919 (in gross tons).

Year.	Open hearth.			Bessemer.	Crucible.	Electric.	Miscellaneous.	Total.
	Basic.	Acid.	Total.					
1903	134,879	265,469	400,348	18,099	5,049	.....	6,409	430,265
1913	460,161	450,055	910,216	80,506	17,571	9,207	3,244	1,020,744
1914	344,144	270,173	604,317	65,882	11,186	8,551	3,310	693,246
1915	333,103	402,229	735,332	92,476	14,756	23,064	1,196	866,824
1916	605,512	570,937	1,176,449	142,791	9,351	42,870	302	1,371,763
1917	558,568	654,588	1,213,156	159,272	3,834	64,911	234	1,441,407
1918	505,880	634,950	1,140,830	160,844	1,330	108,296	110	1,411,410
1919	313,965	448,555	762,520	98,819	1,009	111,510	2,579	976,437

ots and castings—percentage of production of the United States Steel Corporation, 1915–1919.

Year.	Production of United States Steel Corporation (gross tons).	Production all other companies (gross tons).	Total production (gross tons).	Percentage United States Steel Corporation.
.....	16,376,492	15,774,544	32,151,036	50.94
.....	20,910,589	21,863,091	42,773,680	48.89
.....	20,285,061	24,775,546	45,060,607	45.02
.....	19,583,493	24,878,939	44,462,432	44.05
.....	17,200,373	17,470,859	34,671,232	49.61

annual capacity of completed steel furnaces and converters, Dec. 31, 1919 (in gross tons).

States.	Open hearth.	Bessemer.	Crucible.	Electric.	Miscellaneous.	Total.
nusetts.....	286,700	8,700	1,490	21,200	.....	318,090
rk.....	2,414,150	108,760	39,575	129,550	.....	2,692,035
rsey.....	331,800	17,240	19,500	30,300	.....	398,840
lvania.....	18,752,540	3,899,100	129,435	255,880	500	23,037,455
re.....	427,100	10,600	.....	.....	2,000	439,700
d.....	492,500	400,000	1,000	30,000	.....	923,500
rginia.....	128,000	478,000	6,000	50,500	.....	662,500
ky.....	450,000	150,000	.....	.....	.....	600,000
a.....	1,335,000	.....	.....	19,200	.....	1,354,200
.....	8,202,910	4,782,950	340	142,900	.....	13,129,100
.....	4,310,710	8,000	1,550	19,500	.....	4,339,760
.....	2,827,770	1,596,800	5,400	244,385	4,500	4,678,855
ia.....	544,200	1,000	.....	7,400	.....	552,600
o.....	540,000	601,500	.....	2,650	.....	1,144,150
ia.....	234,500	6,730	.....	18,780	.....	260,010
ier, including Canal Panama.....	822,600	80,900	4,700	197,640	500	1,106,340
otal for 1919.....	42,100,480	12,150,280	208,990	1,169,885	7,500	[1] 55,637,135
otal for 1918.....	41,386,145	11,963,430	175,520	956,845	800	[1] 54,482,740

not include the capacity of open-hearth furnaces used for melting stock for electric furnaces or for le works, Bessemer converters used for desiliconizing and decarburizing molten metal, electric used for melting alloys, or electric furnaces used for the manufacture of pig iron or ferro-alloys.

SHAFTING.

Summary.

The only specific provision for shafting in the tariff act of 1913 is for "mill shafting," a product of declining importance, owing to the increased use of individual electric motors for driving shop machines. This product may be considered as an advanced bar of iron or steel, generally having been cold rolled, drawn, turned in a lathe, or ground. Crankshafts—either alloy steel or straight carbon—are ordinarily forged products as are also heavy marine shafts. Flexible shafting is a distinctively American product that is little used abroad and of minor importance in this country as compared with the large amounts of other kinds of shafting consumed.

The production of shafting of the various classes is a large and important industry in the United States, being largely concentrated near consuming centers in the East and in the Central States serving the automobile industry. Production is scattered among a large number of establishments. With some firms the manufacture of shafting is a minor item, but ordinarily in both rolled and forged shafting, it constitutes one of the chief products.

Foreign competition in the domestic market has never assumed large proportions, and while statistics of imports are not available, it is generally known that imports have been negligible. No considerable export trade has developed, although large quantities of American-made shafting and screw stock (an allied product) enter into the manufacture of American machinery and automobiles for export.

General Information.

Paragraph 110 of the act of 1913: * * * mill shafting; * * * all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys * * * 8 per cent ad valorem. * * * swaged steel; * * * when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, and all steels by whatever process made, containing alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, 15 per cent ad valorem.

Description.

A shaft may be defined as a bar or rod, generally made of iron or steel, which is used for transmitting power by rotation. Axles, which are discussed in other surveys, are really a type of shafting, but the term axles is applied only to the shafts which connect with the wheels of a vehicle or about which the wheels revolve. Only mill shafting is mentioned in the tariff act, and this is rather an indefinite term, shafts being ordinarily classed according to the process by

they are made as well as according to the purpose for which are used. A considerable number of classes are distinguished trade, but these may be roughly grouped for tariff consideration the following main types:

Plain hot rolled shafting, a product differing in no way in ods of manufacture or appearance from ordinary steel bars.

Cold-rolled shafting, made from hot rolled bar steel by rolling een carefully adjusted rolls which bring it accurately to the er diameter and a true circumference and impart a hard skin to netal which resists wear.

) Cold-drawn shafting, also made from hot-rolled bar steel but ned by drawing the cold bar through a die (cf. wire) instead of ng. Cold-drawn shafting is often considered to be less variable cold-rolled shafting and is more frequently employed in machinery re the bearings require close adjustment.

) Turned shafting is trued up in a lathe. Usually only a light ing is removed, the bar having been previously forged, rolled, or vn to the approximate size.

) Polished or ground shafting which has been finished by means n abrasive. This is probably the most accurately sized class of ting.

) Forged shafting, especially heavy shafting for marine propeller ts and heavy engine shafts.

) Hollow shafting may be either bored out or made from a ed ingot similar to a heavy tube. It is often used to save weight re large diameters are required.[1]

) Crankshafts, generally forged, but occasionally cast, are a ial product, being made with one or more offsets (cranks) instead mple straight lengths.

) Flexible shafting is a very special, highly-finished machinery luct. As its name implies, it is flexible, consisting of a series of ed sections or spring wire and ordinarily inclosed in a metal- nd tube. The commonest example is the ordinary speedometer t. No considerable amount of power can be transmitted in this and flexible shafting is chiefly used for light apparatus and tools ., dentists').

ll of the above classes of shafting may be made from straight on steel or alloy steel of various kinds. The use of alloy steel, ever, is not common except for small shafts in automobile work especially in crankshafts used in connection with internal com- ion engines. Most of the above classes of shafting may also be le from bronze Monel metal, or other nonferrous metals; but such ting is not considered in this survey which deals only with iron eel shaftings, since bronze or other copper-alloy shafting is used latively small amounts chiefly for mine pumps, boat propeller ts, etc., where acid or rust resisting qualities are desired, and such ts are classed with other manufactures of these alloys.

onferrous metal shafting can not be considered a substitute for or steel shafting, as it is always more expensive in first cost. e has been a marked reduction in the amount of shafting used rious mills, however, as a result of the general adoption of elec- power which permits individual drives for the various machines

[1] 6-inch hollow shaft with a 4-inch hole weighs 16 per cent less than a solid shaft of the same outside er, and the strength is only 2.56 per cent less.

in a factory instead of the long lines of shafting and the great numb of belts found in the older plants.

Iron and steel shafting is a necessary adjunct to all apparatu having moving parts and is largely used in the shipbuilding, auto mobile, aeroplane, electrical, mining, and general manufacturin industries. Cold drawn or rolled screw stock is similar to shaftin in process of manufacture and is made by the same manufacturers. It may be used for small spindles or shafts or, as its name implies, for making bolts and threaded parts.

DOMESTIC PRODUCTION.

The manufacture of steel shafting is a large and important busi- ness in the United States. No statistics are available which show the actual production of the various classes of shafting. Rolled shafting is included with spike and chain rods, bolt and nut rods, tires, horseshoe bars, etc., the production of which reached a maximum in 1917 when it amounted to 1,797,802 gross tons. Most of this may be classed as shafting or closely allied material. This figure, how- ever, does not include the large and valuable output of forged shafts or crankshafts. The manufacture of flexible shafting is a relatively small industry although the product is relatively costly.

Materials.—Wrought iron is not commonly used in shafting. The usual material for either cold rolled or cold drawn shafting is mild bar steel. Steel billets or ingots are used for forged shafts and crank- shafts. Alloy steel is used for certain kinds of shafting and is of considerable importance in the case of automobile crankshafts. All of the materials, however, are in ample supply in the United States and under present conditions American prices are ordinarily lower than foreign prices.

Equipment.—The larger establishments for making rolled shafting are self-contained steel works which make bar steel and then run it through cold rolls or draw it through dies. The manufacture of forged shafts and crankshafts calls for forging hammers, presses and furnaces for heating the material together with annealing fur- naces, pickling tubs, and straightening machines more or less simila to those required in rolling mills.

The equipment of the shops is heavy and expensive, but th American manufacturers are at no disadvantage as compared wit their foreign competitors as regards the initial cost of their plan or equipment.

Methods of production.—The processes in the manufacture of shaf ing are not greatly different from those employed in the productio of other rolled products or of other forgings. The chief differen in the case of cold rolled shafting is the smaller scale of productio and the greater attention to accuracy in setting the rolls. The h rolled bars are first pickled to remove the scale and then forced co through the rolls. Much ordinary machinery and transmissi shafting is simply cold rolled into rounds and cut to the proper lengt but occasionally these shafts are turned or ground down in a lath The final machining removes some of the skin and shows up a defects in the shafting which might be covered up by the cold rollin After rolling, shafting is passed through a straightening machi called a "flyer." Cold drawn shafting is made in sizes up to 2 inch around, the process resembling somewhat the manufacture of wire.

In general the labor employed in making shafting is highly skilled and well paid, even as compared with that in ordinary hot rolling mills. While all the operations are more or less mechanical, skilled supervision is required, together with a certain amount of fairly heavy manual work.

It was stated in tariff hearings in 1909 that the total cost of advancement of steel bars to polished steel shafting was approximately $8.50 per ton, of which two-thirds ($5.30) was represented by direct labor.

Organization.—The manufacture of the simpler forms of shafting calls for large establishments and a wide market. The product is highly standardized and in general demand. The production of marine, automobile, and other special shafting frequently made from alloyed steels and generally forged is secured in smaller factories, medium sized establishments being more adapted to the relatively limited tonnages. According to a report furnished the Tariff Commission, the capital investment required to build and operate a cold-drawn shafting plant of 50,000 tons yearly capacity under present conditions is approximately $1,250,000. It is impossible to give statistics covering the total capital invested in the industry, but it is doubtless in the neighborhood of $500,000,000. This capitalization is scattered among many firms, and in the case of the larger producers the manufacture of shafting is merely one branch of their business. Most of the crank-shaft makers, however, are specialists, although automobile axles may also be produced in the same shop.

The methods of distribution differ according to the class of product. Three principal divisions may be made: (1) Ordinary transmission shafting is chiefly sold through jobbers, who, in addition to shafting, supply general equipment and appurtenances to industrial plants, including hangers, pulleys, clutches, and even belting, etc.; (2) shafting used in the manufacture of various machines is usually bought direct from the shafting factories, which cut it into the desired lengths and do the necessary machining as a step in their own manufacturing operations; (3) the third class is the shafting used in other rough machinery, which is also bought direct by the consumer, but is of lower quality than the high-grade material used by other machinery manufacturers.

Screw stock and cold-drawn shafting is generally sold direct, the jobber only handling small lots of material for special uses. About 75 per cent of this product is standardized, and only 25 per cent comes in special sizes. Fully 50 per cent of the output of this class of material is supplied by three large firms.

Flexible shafting may be sold through machinery tool houses or direct to consumers. On account of the relatively small market, large factories are not required, and since the product is not standardized, most of it is made to special order.

Geographical distribution.—There are almost a hundred manufacturers of shafting in the United States. As in the case of other iron and steel rolled products, Pennsylvania is the largest producer, more than one-third of all the firms in the business being located in that State. Ohio is also a large producer. Shafting plants are located in various other sections of the country, notably New England, New York, New Jersey, Michigan, and in several western and southern States.

History of the industry.—The extensive use of shafting is a direct result of the increased use of power in manufacturing industries. The growth of the textile machinery industry has been especially important in this connection, although every establishment in which power is utilized requires a certain amount of shafting. The automobile industry has stimulated the growth of an entirely new industry devoted to the manufacture of special high-grade, high-duty light shafts and axles which will withstand shock and continual vibration. The manufacture of this type of shafting and, particularly crank shafts, is a highly specialized business, and as compared with ordinary mill shafting these products are highly advanced, both as regards labor and material.

One of the principal developments along these lines has been the production in late years of cold-drawn steel shafting and cold-drawn screw steel. The latter is used as stock in the manufacture of a variety of parts, particularly in the automotive industry. Screw steel requirements are now said to be very much in excess of the demand for shafting.

Domestic production and consumption.—As stated above there are no statistics which clearly represent the domestic production of shafting; the figures given on pages 5 and 6 include in addition to shafting certain other rolled products, but do not include forged shafting or crank shafts.

Since statistics of imports and exports are not published, it is also impossible to prove the balance of trade with foreign countries in these products. According to statements made to the Tariff Commission by manufacturers, the domestic market for cold-worked and flexible shafting is wholly supplied by American firms. Prior to the war, when the prices of domestic steel products were low, there was some heavy forged shafting imported from England, but foreign trade does not seem to have been at any time an important factor in the American industry. Domestic production has increased largely during and since the war. One manufacturer of cold-drawn shafting, for example, reports a double production of screw stock and shafting in 1919 as compared with 1913.

Domestic exports.—The exports of shafting are not listed separately by the Department of Commerce. A manufacturer of cold-drawn shafting reports:

> We have done but little exporting of our product, in fact none at all in the past five years. Previous to that time we exported a very small proportion and found that at all times we could secure the full market price for our product, charging the necessary extras for preparing a shipment for export. These extras were considerably higher than those charged for domestic shipments, owing to the fact that the bars had to be very carefully protected to prevent rusting when exposed to salt air.

It would seem that the exports are practically negligible, although large quantities of shafting are consumed in the manufacture of American machinery, which is sold abroad. Flexible shafting is practically unknown outside of the United States and the exports are, therefore, exceedingly small, although there is some export of flexible shafting attached to American automobiles, speedometers, and small tools consigned to foreign countries.

FOREIGN PRODUCTION.

England and Germany are the largest foreign producers of shafting. ance, Belgium, and Italy are important in this industry chiefly in e manufacture of automobile and internal combustion engine crank afts, the latter also being made in Sweden.

IMPORTS.

In the Department of Commerce classification of imports, shafting included with ingots, etc. Replying to the Tariff Commission's estionnaire, an Ohio manufacturer of cold-drawn shafting reports:

We have never encountered competition of any foreign country in our selling organiion. We sell large tonnages throughout the Eastern part of the United States, where would be most likely to encounter this competition.

On the other hand, another manufacturer states that, prior to the ır, heavy forged shafting was imported from Germany at a price elow cost of manufacture in the United States, owing to the exmely low rates paid for labor in Germany, and it is safe to assume at such conditions might recur in the future." It would not appear at any considerable quantities of shafting have been imported in e years.

PRICES.

It is difficult to present figures to show representative prices of the rious classes of shafting. Cold-drawn shafting as well as cold-lled is generally sold on the basis of hot-rolled steel quotations. r example, one manufacturer quotes shafting at $3.60 base per ndredweight (subject to extras for odd smaller sizes, quantities, .), as compared with contemporaneous quotations of $2.35 per ndredweight on bar steel. Another manufacturer reports a price September, 1920, of 4.55 cents per pound, or $101.92 per gross ton, compared with $42 per gross ton in 1912.

TARIFF HISTORY.

In the tariff acts of 1883, 1890, and 1894 provision was made for amer, crank, and other shafts at rates of duty either specific or ad lorem, varying according to the value of the product per pound. In act of 1897 these various classifications were not included and only ill shafting" was mentioned. This was dutiable at three-tenths t per pound when valued at 1 cent per pound or less, the duties reasing on a sliding scale to $4\frac{7}{10}$ cents per pound on shafting valued ver 16 cents per pound, which were the same rates as those adopted 894 but considerably lower than those provided in the act of 1890. the act of 1909 provision was made for mill shafting valued at ee-fourths of 1 cent per pound and under, which was dutiable at en-fortieths of a cent. The rates on material valued above three-rths cent per pound up to 40 cents were on a sliding scale, varying h value, the ad valorem equivalent decreasing from 30 per cent in case of shafting valued at 1 cent per pound to $17\frac{1}{2}$ per cent (7 cents pound) for shafting valued between 32 cents and 40 cents per nd. An ad valorem rate of 20 per cent was imposed on mill fting valued above 40 cents per pound. In the 1913 act mill

PRICES—WHOLESALE AVERAGE PRICE PER 100 POUNDS.

Shafting.

[Data reported by one manufacturer.]

Year.	Shafting (cold-drawn).	Steel bars (for comparison).
1900	$3.08	.....
1901	2.29	.....
1902	2.60	.....
1903	2.75	.....
1904	2.46	.....
1905	2.46	.....
1906	2.48	.....
1907	2.43	.....
1908	2.46	.....
1909	2.28	$1.33
1910	2.49	1.44
1911	2.14	1.28
1912	1.92	1.29
1913	2.21	1.55
1914	2.03	1.15
1915:		
January	1.92	1.10
February	1.88	1.10
March	1.96	1.15
April	2.05	1.20
May	2.04	1.20
June	1.90	1.21
July	2.04	1.25
August	2.08	1.30
September	2.09	1.34
October	2.09	1.44
November	2.17	1.62
December	2.30	1.84
1916:		
January	2.40	2.03
February	2.66	2.31
March	2.78	2.65
April	3.02	2.88
May	2.96	3.00
June	3.33	2.75
July	3.39	2.63
August	3.92	2.56
September	3.88	2.60
October	3.73	2.75
November	4.18	2.83
December	4.24	3.00
1917:		
January	4.07	3.15
February	4.31	3.25
March	4.40	3.63
April	4.66	3.75
1917—Continued.		
May	$4.89	$4.00
June	4.93	4.38
July	5.24	4.50
August	5.56	4.50
September	5.30	4.00
October	5.45	2.90
November	5.07	2.90
December	4.95	2.90
1918:		
January	5.33	2.90
February	5.32	2.90
March	4.99	2.90
April	5.13	2.90
May	4.93	2.90
June	5.19	2.90
July	4.81	2.90
August	4.91	2.90
September	5.04	2.90
October	5.01	2.90
November	5.30	2.90
December	4.86	2.80
1919:		
January	4.77	2.70
February	4.90	2.70
March	4.62	2.61
April	4.43	2.35
May	4.35	2.35
June	4.42	2.35
July	4.47	2.35
August	4.16	2.35
September	4.11	2.35
October	4.17	2.39
November	4.11	2.69
December	4.11	2.75
1920:		
January	4.16	.....
February	4.26	.....
March	4.25	.....
April	4.09	.....
May	4.60	.....
June	4.32	.....
July	4.27	.....
August	4.43	.....
September	4.55	.....

evert to those existing in prewar times, it may be possible to obtain material of this character cheaper on the other side, although it has been our experience that American shipbuilders rarely avail themselves of such opportunities owing to the delays that necessarily exist in obtaining deliveries from the other side."

TARIFF CONSIDERATIONS.

The designation "mill shafting" is not definite, but is a general term applied to any sort of shafting used for ordinary line shafting for the distribution of power by rotation in factories. The designation "shafting" would be preferable. Since the base prices are only slightly in advance of those for steel bars, it might be best to group shafting with this less highly finished product on the basis of an ad valorem duty, in spite of the fact that the labor involved in this advancement constitutes a somewhat larger item than it does in any previous step in the advancement.

PRODUCTION IN UNITED STATES.

Shafting—Spike and chain rods, bolt and nut rods, horseshoe bars, strips, shafting, etc.[1]

[Annual Statistical Report, American Iron and Steel Institute.]

Year.	Gross tons.	Year.	Gross tons.
1915	1,227,455	1918	1,793,734
1916	1,669,228	1919	1,487,423
1917	1,797,802		

[1] Separate statistics for rolled shafting are unobtainable. In addition to the shafting included in these figures considerable quantities of forged shafting and crankshafts are produced in the United States.

PRICES—WHOLESALE AVERAGE PRICE PER 100 POUNDS.

Shafting.

[Data reported by one manufacturer.]

Year.	Shafting (cold-drawn).	Steel bars (for comparison).
1900	$3.08	.....
1901	2.29	.....
1902	2.60	.....
1903	2.75	.....
1904	2.46	.....
1905	2.46	.....
1906	2.48	.....
1907	2.43	.....
1908	2.46	.....
1909	2.28	$1.33
1910	2.49	1.44
1911	2.14	1.26
1912	1.92	1.29
1913	2.21	1.55
1914	2.03	1.15
1915:		
January	1.92	1.10
February	1.88	1.10
March	1.96	1.15
April	2.05	1.20
May	2.04	1.20
June	1.90	1.21
July	2.04	1.25
August	2.08	1.30
September	2.09	1.34
October	2.09	1.44
November	2.17	1.62
December	2.30	1.84
1916:		
January	2.40	2.03
February	2.66	2.31
March	2.78	2.65
April	3.02	2.88
May	2.96	3.00
June	3.33	2.75
July	3.39	2.63
August	3.92	2.56
September	3.88	2.60
October	3.73	2.75
November	4.18	2.83
December	4.24	3.00
1917:		
January	4.07	3.15
February	4.31	3.25
March	4.40	3.63
April	4.66	3.75
1917—Continued.		
May	$4.89	$4.00
June	4.93	4.38
July	5.24	4.50
August	5.56	4.30
September	5.30	4.00
October	5.45	2.90
November	5.07	2.90
December	4.95	2.90
1918:		
January	5.33	2.90
February	5.32	2.90
March	4.90	2.90
April	5.13	2.90
May	4.93	2.90
June	5.19	2.90
July	4.81	2.90
August	4.91	2.90
September	5.04	2.90
October	5.01	2.90
November	5.30	2.90
December	4.86	2.80
1919:		
January	4.77	2.70
February	4.90	2.70
March	4.62	2.61
April	4.43	2.35
May	4.35	2.35
June	4.42	2.35
July	4.47	2.35
August	4.16	2.35
September	4.11	2.35
October	4.17	2.39
November	4.11	2.69
December	4.11	2.75
1920:		
January	4.16	.....
February	4.26	.....
March	4.25	.....
April	4.09	.....
May	4.60	.....
June	4.32	.....
July	4.27	.....
August	4.43	.....
September	4.55	.....

RATES OF DUTY.

Shafting.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
177	* * * steamer, crank, and other shafts; * * * all of the above classes of steel not otherwise specially provided for in this act, valued at 4 cents a pound or less.	45 per cent ad valorem.
	Above 4 cents a pound and not above 7 cents per pound.....	2 cents per pound.
	Valued above 7 cents and not above 10 cents per pound.....	2½ cents per pound.
	Valued at above 10 cents per pound.....	3½ cents per pound.
146	* * * steamer, crank, and other shafts; shafting; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
	Valued above 1 cent and not above $1\frac{4}{10}$ cents per pound.....	$\frac{7}{10}$ cent per pound.
	Valued above $1\frac{4}{10}$ cents and not above $1\frac{7}{10}$ cents per pound...	$\frac{8}{10}$ cent per pound.
	Valued above $1\frac{7}{10}$ cents and not above $2\frac{3}{10}$ cents per pound...	$\frac{9}{10}$ cent per pound.
	Valued above $2\frac{3}{10}$ cents and not above 3 cents per pound.....	$1\frac{1}{10}$ cents per pound.
	Valued above 3 cents and not above 4 cents per pound.....	$1\frac{3}{10}$ cents per pound.
	Valued above 4 cents and not above 7 cents per pound.....	2 cents per pound.
	Valued above 7 cents and not above 10 cents per pound.....	$2\frac{5}{10}$ cents per pound.
	Valued above 10 cents and not above 13 cents per pound.....	3½ cents per pound.
	Valued above 13 cents and not above 16 cents per pound.....	$4\frac{3}{10}$ cents per pound.
	Valued above 16 cents per pound.....	7 cents per pound.
122	* * * steamer, crank, and other shafts; shafting; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
	Valued above 1 cent per pound and not above $1\frac{4}{10}$ cents per pound.	$\frac{7}{10}$ cent per pound.
	Valued above $1\frac{4}{10}$ cents per pound and not above $1\frac{7}{10}$ cents per pound.	$\frac{8}{10}$ cent per pound.
	Valued above $1\frac{7}{10}$ cents per pound and not above $2\frac{3}{10}$ cents per pound.	$\frac{9}{10}$ cent per pound.
	Valued above $2\frac{3}{10}$ cents per pound and not above 3 cents per pound.	$\frac{10}{10}$ cent per pound.
	Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{3}{10}$ cents per pound.
	Valued above 4 cents per pound and not above 7 cents per pound.	$1\frac{5}{10}$ cents per pound.
	Valued above 7 cents and not above 10 cents per pound.....	$1\frac{8}{10}$ cents per pound.
	Valued above 10 cents and not above 13 cents per pound.....	$2\frac{3}{10}$ cents per pound.
	Valued above 13 cents and not above 16 cents per pound.....	$2\frac{8}{10}$ cents per pound.
	Valued above 16 cents per pound.....	$4\frac{3}{10}$ cents per pound.
135	* * * mill shafting; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
	Valued above 1 cent and not above $1\frac{4}{10}$ cents per pound.....	$\frac{7}{10}$ cent per pound.
	Valued above $1\frac{4}{10}$ cents and not above $1\frac{7}{10}$ cents per pound..	$\frac{8}{10}$ cent per pound.
	Valued above $1\frac{7}{10}$ cents and not above $2\frac{3}{10}$ cents per pound..	$\frac{9}{10}$ cent per pound.
	Valued above $2\frac{3}{10}$ cents and not above 3 cents per pound.....	$\frac{10}{10}$ cent per pound.
	Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{3}{10}$ cents per pound.
	Valued above 4 cents and not above 7 cents per pound.	$1\frac{5}{10}$ cents per pound.
	Valued above 7 cents and not above 10 cents per pound.....	2 cents per pound.
	Valued above 10 cents and not above 13 cents per pound.....	$2\frac{3}{10}$ cents per pound.
	Valued above 13 cents and not above 16 cents per pound.....	$2\frac{8}{10}$ cents per pound.
	Valued above 16 cents per pound.....	$4\frac{3}{10}$ cents per pound.
131	* * * mill shafting; * * * all of the above valued at ¾ of 1 cent per pound or less.	$\frac{3}{10}$ cent per pound.
	Valued above ¾ of 1 cent and not above 1 ¾cents per pound...	$\frac{4}{10}$ cent per pound.
	Valued above $1\frac{4}{10}$ cents and not above $1\frac{7}{10}$ cents per pound...	$\frac{5}{10}$ cent per pound.
	Valued above $1\frac{7}{10}$ cents and not above $2\frac{7}{10}$ cents per pound...	$\frac{6}{10}$ cent per pound.
	Valued above $2\frac{7}{10}$ cents and not above 3 cents per pound.....	$\frac{7}{10}$ cent per pound.
	Valued above 3 cents and not above 4 cents per pound.....	$1\frac{1}{10}$ cents per pound.
	Valued above 4 cents and not above 7 cents per pound.....	$1\frac{3}{10}$ cents per pound.
	Valued above 7 cents and not above 10 cents per pound.....	$1\frac{6}{10}$ cents per pound.
	Valued above 10 cents and not above 13 cents per pound.....	$2\frac{1}{10}$ cents per pound.
	Valued above 13 cents and not above 16 cents per pound.....	$2\frac{6}{10}$ cents per pound.
	Valued above 16 cents and not above 24 cents per pound.....	$4\frac{1}{10}$ cents per pound.
	Valued above 24 cents and not above 32 cents per pound.....	6 cents per pound.
	Valued above 32 cents and not above 40 cents per pound.....	7 cents per pound.
	Valued above 40 cents per pound.....	20 per cent ad valorem.
110	* * * mill shafting; * * * all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or * * * similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	8 per cent ad valorem.

STEEL CASTINGS.

SUMMARY.

A steel casting is steel shaped by running the melted metal into a mold of desired form instead of by rolling or forging. A casting may be made of either ordinary carbon or alloy steel. Among important uses are those for machinery and automotive parts, cylinders, heavy chain, gun parts, railway wheels, stern forms for ships, locomotive and car parts, couplers and trucks.

The domestic output of steel castings amounted to 1,411,410 gross tons in 1918 and 976,437 gross tons in 1919. While the greater part of the steel used in the manufacture of castings is Bessemer and open-hearth the proportion of crucible, electric, and other high-grade steel employed is greater than in the case of ingots. In 1919, for example, only 1 per cent of the ingots made in the United States was manufactured out of crucible, electric, and similar steel, while nearly 12 per cent of the steel castings were so made.

Published figures of imports cover forms of crude steel other than castings, and hence it is impossible to state with any degree of exactness how far the foreign product competes with the domestic. In addition to these imports are other castings in the forms of railway wheels, chains, and the like. Most of the imported castings came from Canada.

The published figures for exports include only castings but do not distinguish between castings made of iron or of steel. The value of these exports greatly exceed that of the imports of all classes of crude steel and steel castings. In 1920 it was $6,810,511 aside from exports of car wheels, chains, and some other cast forms.

With reference to castings made of Bessemer and open-hearth steel the American producer meets little foreign competition. Electric steel castings are manufactured in large amounts in Canada and much of this material is imported into the United States. Hydro-electric power, which is employed in the manufacture of such steel, as well as many other furnace products, is cheaper in Canada than in the United States, and such power is an important item in the total cost of manufacture.

The variations in the value of castings are great and numerous. Hence steel castings do not lend themselves so well to specific as to ad valorem duties.

Steel castings—Summary table.[1]

Fiscal year.	Domestic production.[2 3]	Domestic exports.[4]
	Gross tons.	*Value.*
----	940,832	$2,061,028
----	646,627	3,213,727
----	966,621	2,964,471
----	1,020,744	3,564,014
----	693,246	2,631,907
----	866,824	1,288,131
----	1,371,763	2,982,675
----	1,441,407	8,515,637
----	1,411,410	4,265,558
[illegible]	1,411,410	4,535,553
[illegible]	976,437	4,508,044
----	1,251,542	6,810,511

[1] Imports for consumption statistics not available.
[2] Annual Statistical Report for 1920, American I. & S. Institute.
[3] Calendar year.
[4] Includes both iron and steel castings.

General Information.

1913 TARIFF, PARAGRAPH 110.

* * * All descriptions and shapes of dry sand, loam, or iron olded steel castings, sheets, and plates; * * * if made by the essemer, Siemens-Martin, open-hearth, or similar processes, not ntaining alloys, 8 per cent ad valorem.

* * * All descriptions and shapes of dry sand, loam, or iron olded castings, sheets, and plates; * * * made by the crucible, ectric, or cementation process, either with or without alloys, 15 per nt ad valorem.

(Note.—Other paragraphs specifically mention certain steel cast-gs, as for example, paragraph 142, wheels for railway purposes or rts thereof, 20 per cent.)

DESCRIPTION.

A steel casting is cast steel formed by running the melted metal to a mold of any desired form. For this purpose both carbon and loy steels are employed.

The uses of steel castings are: For machinery and automotive parts, linders, heavy chain, shoes for caterpillar tractors, gun parts, ilway wheels, stern frames for ships, locomotive and car parts, uplers, trucks, spring gears, yokes, bolsters, mill pinions, couplings, ars, mill tables, die blocks, anchors, and numerous other articles. f growing importance is the substitution of castings for parts rmerly produced wholly by forging. Cold drawn and pressed steel rts, which are special types of forgings, are also substitutes for stings.

Steel castings are of great importance in the manufacture of railway uipment, ships, automotive parts, machinery, and military equip-ent. During the war it was necessary to cast vast numbers of eel shells and after all the steel foundry capacity was employed ans were made to produce great quantities of semisteel shells in the on foundries. Semisteel is a product of great possibilities and is t mentioned in the tariff act of 1913. These castings are made of rt steel scrap and part pig iron.

DOMESTIC PRODUCTION.

The manufacture of steel castings is an important industry in the United States, the value of the output in 1914 being almost $45,000,000.

Raw materials.—Supplies of domestic steel scrap are obtained from the railroads, steel works, and many other sources. Pig iron is available at various blast furnaces in the United States, and the domestic supply is deficient only on the Pacific coast.

The acid process in the manufacture of castings requires materials low in phosphorus. As low-phosphorus materials produce sounder castings, and as these materials of the desired grade are not plentiful, there is a premium paid for pig iron and steel scrap which has an especially low phosphorus content.

While many alloys are imported, it may be said that domestic manufacturers are not ordinarily at a disadvantage in procuring materials. The electric process, which is well adapted to making steel castings, can use large percentages of scrap, and since the development in recent years of the use of electric furnaces on the Pacific slope, the lack of pig iron in that section of the country has lost much of its importance in the manufacture of steel castings.

Supplies of alloy ores and ferroalloys are dealt with in other surveys prepared by the Tariff Commission.

Equipment.—In general the equipment consists of Bessemer converters, crucible steel, and open-hearth furnaces, patterns, molding machines, rammers, sand conveyers, cranes, barrel tumblers, sand-blasting, chipping, and grinding machines, annealing boxes, welding outfits, and other equipment and machines.

American founders are at no disadvantage in procuring equipment; this is procured in the domestic market.

Methods of production.—The subject of casting methods is so broad, and the processes involved are so complex, that it is not possible in the scope of this survey to describe them in detail.

The processes employed are the crucible, electric, small Bessemer, and the acid and basic open-hearth, which are given a general description in the "Ingot" survey. It may be said that the peculiar objects to be arrived at in making steel castings by any process is to obtain a hot fluid steel free from blowholes caused by gases. Some details of methods of manufacture will be found under "Miscellaneous," *infra*.

The crucible process, using the purest materials and forming no gases in the steel produces high-grade castings; but this is a costly process and does not make heavy castings. For high-grade, special quality castings, this process will probably always prevail.

The small Bessemer has the advantage of producing hot, fluid metal.

The open-hearth is a large, economical producer of castings and the acid open-hearth makes high-grade steel for castings. Small furnaces are preferred.

The electric process is growing in favor. It makes high-grade steel from cheap materials, hot and fluid and in units up to 30 tons from a single furnace, and it is possible to combine the casts from more than one furnace.

Pattern making is a fundamental detail of steel casting manufacture. Cast steel has a much greater shrinkage than cast iron and the castings are so important in quality, and often in size, and the

n is so complicated that the pattern maker has to have much rience and skill, often amounting to genius.

lding is not now as dependent on skilled molders as formerly, se molding machines and hydraulic rammers have replaced molders.

uring.—The temperature at which the steel is poured is very rtant, and the ladle man must be experienced and skillful; hing must be avoided.

aning.—After the casting has cooled in the mold it is taken out he sand either brushed off, if the casting is large, or put into ling barrels, if the casting is small, where the use of "stars" of iron clean them properly. Much of the work of cleaning is done nd blasting, which has the advantage of giving the best appear- rface; besides sand-blasted material lends itself to pickling and ual enameling or galvanizing more readily than other forms of ing. After sand cleaning, necessary chipping operations are rmed on castings to remove gates, fins, and scabs; for this pur- in modern plants, pneumatic chisels are used.

tings are annealed to toughen them and remove their brittle-

rge foundries make much use of machinery throughout the us operations of casting and auxiliary work, and there is a high e of standardization. Male labor is employed in foundries t exclusively.

anization.—The manufacture of steel castings offers a large for ingenuity and research, and necessitates efficient organiza- nd unceasing care for routine details. The variety of skilled s represented in a large steel foundry, the manner in which the ent operations intermesh, and the multitude of things that may rong" make the business as a whole complex in the extreme, ery costly as compared to iron-foundry or steel-mill operations. w of this statement it may seem a paradox to state that the crucible steel-casting plant is likely to continue. The low lation cost and simplicity of operation naturally appeal to the or of small means, who is so situated as to supply a local t for small castings, the basis of purchase of which is prompt ry and superior quality rather than price per pound.

arge market is essential to the highly organized industry, and available to the domestic producer. The business is scattered many firms, and there is one consolidation of interests that lants at several industrial centers. One hundred and forty are listed by the trade journal, Raw Material. The capital ed is not necessarily great in a steel-casting plant; indeed some oundries have installed steel-casting equipment. The con- s are cheap, costing, prior to 1914, less than $5,000 each. The f installation of a 2½-ton electric furnace is about $25,000.

installation costs of the open-hearth furnace are high, being lly about $3,000 per ton capacity for the furnace alone; as plant may have several 30-ton furnaces, the investment in e equipment would probably be about $500,000. The leading st in the United States is capitalized at $17,184,000 stock and ,100 bonds, outstanding January 1, 1915, with open-hearth es of about 600 tons capacity and a production of 361,300 tons

of steel castings per year. This organization produced during the period of the war 295,207 tons of ingots for shells, with only one-half as much steel discarded (22 per cent) as was discarded of rolled shell steel (44 per cent).

Geographical distribution.—Steel-casting plants are scattered all over the country. There are several plants at Tidewater, at Chester, Pa., and along the Great Lakes at Buffalo, Cleveland, and Milwaukee. Like other steel works, they are mostly in the great industrial belt, from New England to Chicago, Pennsylvania having the largest number. The Federal census of 1910 listed 115 establishments, of which 42 were in Pennsylvania.

History of the industry.—The city of Sheffield, in England, originated the making of steel castings, through the development of the crucible process by Benjamin Huntsman, a clockmaker, in 1740. For more than a century the crucible was the principal unit employed in steel making, and it is still a factor of some importance in the manufacture of small steel castings. In 1856 Henry Bessemer invented the converter for transforming iron into steel at Sheffield for the manufacture of large steel castings and guns. In 1864 Adamson experimented with lateral blowing through multiple tuyeres, and eventually a converter suitable for general foundry work was developed. The open-hearth furnace, which is also used for making steel castings, was invented by Siemens and Martin in 1861. The electric furnace was made commercially successful in 1898. The war greatly stimulated the production of steel castings, particularly for projectiles and guns.

Domestic production and consumption.—The Federal census gives the production of steel castings for 1914 as 569,201 tons, valued at $44,733,698; of this 11,828 tons were of alloy steel.

The American Iron and Steel Institute reports an output in 1913 of 1,020,744 gross tons of steel castings. In 1920 the country's production amounted to 1,251,542 gross tons, distributed, according to the kind of steel used, as follows:

	Carbon and alloy steel.	Alloy steel.
	Gross tons.	*Gross tons.*
Basic open hearth	449,330	2,29
Acid open hearth	537,270	24,55
Bessemer	104,980	19,74
Crucible	1,729	7
Electric	155,196	11,710
Miscellaneous	3,237	
Total	1,251,542	68,33

The value, estimated on the basis of railroad castings in May, 1920, of $156.60 a ton would be about $195,991,480, which is doubtless a low valuation, as there is a considerable tonnage of alloy steel castings and of smaller castings of special design and quality, which are more costly than ordinary railroad castings.

Domestic exports indicate that the United States has a surplus manufacturing capacity.

Domestic exports.—Official United States statistics of exports do not distinguish between iron castings and steel castings, the total for the fiscal year 1913 being valued at $3,564,014; in 1917, at

$8,515,637, and in 1918, at $4,265,558. In the calendar year 1919 this total was valued at $4,508,044, and in 1920, at $6,810,511.

Canada takes about one-half to two-thirds of the exports from the United States. The remainder of the exports is distributed among 75 to 90 different foreign countries.

American castings compete widely in the world's markets with castings exported by European countries. Substantial quantities shipped annually to the producing European countries would indicate that American manufacturers are at no particular disadvanage in foreign markets.

FOREIGN PRODUCTION.

Germany and the United Kingdom, in the order named, were, before the war (1914–1918), the largest foreign producers of steel castings. The United States, while long the world's largest producer, was slightly exceeded by Germany in 1917. However, that country probably will not again occupy even second place in the world's production of steel castings. The loss of the iron mines of Lorraine and Luxemburg means a drastic reduction in the output of Germany. As a result of the war the United Kingdom now occupies second place, and it is probable that France after rehabilitation will exceed the production of Germany and may even attain second place in the world's industry.

The following statistics of production of steel castings in foreign countries have been published:[1]

Year.	United Kingdom.	Germany.	Italy.	Austria.
	Gross tons.	*Metric tons.*	*Metric tons.*	*Metric tons.*
1913	.....	362,916	.....	.....
1916	188,669	1,198,379	24,402	41,034
1917	186,920	1,495,074	35,441	36,506
1918	306,851	1,312,281	.....	.....

Statistics of production in France are not available. In 1918, the United Kingdom produced 44,901 tons of electric steel castings.

IMPORTS.

Official statistics of Commerce and Navigation of the United States include ingots, blooms, etc., with steel castings. Separate figures for steel castings are not available. Imports of electric steel castings from Canada are known to be large compared with castings of other steel from other countries.

PRICES.

Owing to the variety of products and the great differences in value per unit of weight, it is impossible to obtain price records which may be considered representative of the industry. Prices are not quoted in the trade journals. They are special, and furnished upon application to the producers for quotations based on specifications and drawings. One manufacturer making railroad steel castings stated to the Commission that the prices received by his company averaged in May, 1920, $151.60 per long ton; these are standard

[1] Mineral Industries and Statistical Report of National Federation of Iron and Steel Manufacturers, 1918.

parts. The most valuable business is the special cast steel of ticular material and design.

TARIFF HISTORY.

The trend of import duties has been downward.

In 1894 the duties ranged from 0.3 cent per pound on castings valued at 1 cent a pound to 4.7 cents a pound on castings valued above 16 cents a pound. In 1897 there was no cha in 1909 the duty was reduced to a range on steel castings va at three-fourths cent a pound to that of 7 cents a pound on cast valued up to 40 cents a pound, and 20 per cent ad valorem on ings valued at over 40 cents a pound. In 1913 the duty was fixe 8 per cent ad valorem if made from Bessemer or open-hearth without alloys and 15 per cent ad valorem if made from crucible, tric or cementation steel, with or without alloys.

COMPETITIVE CONDITIONS.

The United States has for many years led the world in the pro tion of steel castings. The United Kingdom and Germany have the only other countries of much consequence in the world mar Since the war (1914–1918) conditions have changed materi Germany, temporarily at least, has been practically eliminated conditions in the United Kingdom have for the present weak the competitive strength of that country. Whereas the Un Kingdom is now (1920) the leading foreign producer of steel cast it may be possible that France, with its newly acquired iron m in Lorraine, may become an important factor and may even ex the output of the United Kingdom.

In recent years much difficulty has been experienced in both United Kingdom and France in obtaining adequate supplies of Labor and other costs have advanced in proportions fully equa those of the United States, transportation has become more diffi (owing largely to the depreciation in efficiency of railway equipm after strenuous use and neglect during the war period), and diminished buying power of the currency of these nations has duced the purchases of necessary raw material.

TARIFF CONSIDERATIONS.

As shown in the surveys on pig iron, steel ingots, etc., and s iron and steel, the materials used in the manufacture of ordi carbon steel are abundant and cheap in the United States. In production of Bessemer and open-hearth steel castings, the Amer manufacturer is at no disadvantage in his competition with for rivals.

In the manufacture of castings out of alloy steels, some alloy metals and ferroalloys are obtained in some countries more che than in the United States. Thus chromium and ferrochrome cheaper in France and ferromanganese is generally cheaper in E land than in this country. Some countries, too, have cheaper hy electric power than the United States, and with respect to power as an item in converting pig iron and scrap into electric steel t have competitive advantages.

ssification, castings are usually distinguished from ingots, 'e castings made in iron molds of simple form, generally by 72 inches. The former tariff board made a distinction "worked" castings and castings not worked. Where the after the completion of the casting process, has had work d upon it in the nature of surface operations or alterations to fit it for some special purpose, advancing it beyond the naterial known as foundry castings, it may be considered as ." On the other hand the removal of gates and seams, the ıg of broken surfaces on castings, the cutting to length, or h casting with oil, paint or tar, or graphite priming, is not to class them as "worked."

c duties are not so applicable to steel castings as ad valorem 'he variations in price are too numerous for such classifica- 'ould be necessary if specific rates were imposed. Steel cast- of various and often complicated designs, requiring great ce and skill for patterns, molds, annealing, heat treating, hing. Pattern makers are high-paid labor, and a set of pat- an automobile cylinder may cost as much as $3,000.

gings are substitutes more or less for steel castings, too great on in duties between the two might influence the use of one her kind of steel.

Miscellaneous.

MELTING.

ner losses are from 2 to 4 per cent in melting charges in the ınd from 10 to 12 per cent in oxidizing the metalloids and in the charge. The open hearth takes a charge of about scrap, the balance pig iron. The acid process requires low rus, and the basic uses higher phosphorus materials. Man- used in all steel processes.

llowing charges have been employed:

Crucible steel.

Kinds of material.	Quantity.
	Pounds.
low phosphorus)	1,330
ites, etc	660
castings	10
	12

Bessemer steel.

Kinds of material.	Charge with high percentage of pig iron.	Charge with high percentage of scrap.
	Pounds.	*Pounds.*
iron	[1] 448	[2] 448
l casting scrap	336	672
	40	45
	10	10
	140–196	140–196

[1] about 0.08 per cent and silicon 3.5 per cent.
[2] silicon.

ANALYSES.

Low carbon electric steel casting.

Kinds.	Percentage of—				
	Carbon.	Silicon.	Manganese.	Phosphorus.	Sulp
Castings from scrap	0.08–0.18	0.08–0.10	0.04	0.06	
Tool steel	.89	.27	.30	.015	
Steel castings	.12	.037	.18	.005	T

ABSTRACT OF SPECIFICATIONS FOR STEEL CASTINGS.[2]

Class A, ordinary.

Class B, castings for which physical requirements are specifie hard, medium, soft.

Castings made by open-hearth or other process approved by purchaser.

	Class A.	Class B.
Chemical:		
Carbon	Not over 0.3 per cent.	
Phosphorus	Not over 0.06 per cent.	Not over 0.05 per c
Sulphur		Do.

	Hard.	Medium.	Sof
Physical, class B:			
Tensile strength—pounds square inch	80,000	70,000	60
Yield point—pounds square inch	[1] 0.45		
Elongation in 2 inches per cent	15	18	
Reduction in area do	20	25	

[1] Tensile strength.

A test to destruction may be substituted for tension and bend tes on small castings.

United States Navy Department Specifications 49S1e, November 1918, may be found by consulting the auxiliary file of the Tar Commission.

SEMISTEEL CASTINGS.

Castings are also made from a mixture of pig iron or cast-iron scra and scrap steel, a saving being claimed of $10 a ton in costs by usin scrap steel, and also that stronger castings are made. The Unite States War Department ordered 300,000,000 semisteel shells durin the war (1914–1918), and the French used semisteel shells largely t supplement rolled-steel shells, and to reduce the cost.

[2] American Society for Testing Materials, A 27–16.

AMERICAN COSTS.

[As reported to the Tariff Commission by manufacturers in September, 1920.]

Railway castings, basic open-hearth, per ton:	
Liquid steel	$55.00
Patterns	2.00
Molding and core (machine molding and core, $10.15)	25.00
Chipping, sand-blasting, grinding, and shipping	15.00
Annealing	3.00
Maintenance and overhead	35.00
Total cost	135.00
Selling price	151.60
Castings, basic open-hearth, per pound:	Cents.
Liquid steel poured—all labor and material	2.913
Molding and core making, shaking out, etc.—all foundry labor and material, except maintenance	3.236
Cutting apart, chipping, sand-blasting—all labor and material in cleaning, except maintenance, annealing, grinding, and shipping	1.073
Annealing—labor and fuel	.049
Grinding and shipping—labor only	.114
Maintenance, general overhead, and depreciation	1.346
Total	8.731

Establishments in the United States—By States.

[Figures from Federal census.]

States.	1905		1910	
	Number of establishments.	Tons.	Number of establishments.	Tons.
California	(1)	(1)	1	(1)
Colorado	(1)	(1)	1	.....
Connecticut	(1)	(1)	1	(1)
Delaware	(1)	(1)	3	7,827
Illinois	7	56,038	8	74,613
Indiana	3	8,709	3	13,601
Kentucky	.....	.....	1	(1)
Massachusetts	.....	.....	5	7,031
Michigan	(1)	(1)	5	10,450
Minnesota	.....	.....	1	.....
Missouri	(1)	(1)	1	(1)
New Jersey	4	11,656	5	18,661
New York	5	35,605	7	26,410
Ohio	8	35,156	16	93,926
Oregon	.....	.....	1	.....
Pennsylvania	26	114,411	42	197,405
West Virginia	.....	.....	1	(1)
Wisconsin	8	9,215	13	16,742
All other	12	16,535	.....	38,190
Total	73	287,325	115	504,856

[1] Included in "all other."

PRODUCTION IN UNITED STATES.

Steel castings.

[Figures from Federal census, 1914.]

Kind.	1899		1904		1909		1914
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Gross tons.		*Gross tons.*		*Gross tons.*		*Gross tons.*
Open-hearth basic	36,524	$2,628,247	89,671	$5,775,663	268,253		301,298
Open-hearth acid	129,005	10,376,344	182,330	12,964,150	234,341		228,742
Bessemer	3,761	322,465	14,427	1,690,629	34,465		43,457
Crucible	3,643	486,448	3,860	388,101	10,021		8,929
Electric and all other	4,223	796,389	1,221	128,857	2,155		6,288
Total	177,156	14,609,893	291,509	20,947,400	549,235	$42,537,158	588,691

Bessemer steel castings.

[Figures from Federal census.]

States.	1899		1904		1909	1914
	Quantity.	Value.	Quantity.	Value.		
	Gross tons.		*Gross tons.*		*Gross tons.*	*Gross tons.*
Michigan, Minnesota, and Wisconsin	3,000	$278,500	4,295	$375,326		
All other	761	43,965	10,132	1,315,303		
Total	3,761	322,465	14,427	1,690,629	34,465	43,457

Open-hearth steel castings.

[Figures from Federal census.]

States.	1899		1904		1909	1914
	Quantity.	Value.	Quantity.	Value.		
	Gross tons.		*Gross tons.*		*Gross tons.*	*Gross tons.*
Ohio	18,102	$1,410,738	37,596	$2,487,753		
Illinois and Indiana	44,407	3,115,563	64,016	4,626,238		
Pennsylvania	68,176	5,551,312	113,453	7,889,426		
All other	34,844	2,926,978	56,936	3,736,396		
Total	165,529	13,004,591	272,001	18,739,813	502,594	529,993

Crucible steel castings.

[Figures from Federal census.]

State.	1899		1904		1909	1914
	Quantity.	Value.	Quantity.	Value.		
	Gross tons.		*Gross tons.*		*Gross tons.*	*Gross tons.*
Connecticut and New York	1,674	$225,475				
Indiana, Illinois, and Wisconsin	1,086	157,924				
Indiana, Illinois, Ohio, Tennessee, and Wisconsin			2,233	$220,211		
All other	883	103,049	1,627	167,890		
Total	3,643	486,448	3,860	388,101	10,021	8,929

Steel castings.

ures from Annual Statistical Report for 1919, American Iron and Steel Institute.]

Year.	Gross tons.	Year.	Gross tons
.....	940,832	1915.....	866,824
.....	646,627	1916.....	1,371,763
.....	966,621	1917.....	1,441,407
.....	1,020,744	1918.....	1,411,410
.....	693,246	1919.....	976,437

Steel castings.

[Figures from Federal census.]

e.	1899[1]		1904[1]		1909[1]		1914[1]	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
.....	.....	.....	1,747	$52,209	.....	.....	.....	.....
orado, Mis-, and Wash-								
.....	[2]9,773	$729,817	8,305	605,728	.....	.....	.....	.....
.....	1,062	132,442	2,446	321,550	.....	.....	.....	.....
ode Island, usetts.....	[3]6,708	470,114	1,348	161,107	.....	.....	.....	.....
.....	39,023	2,660,767	56,038	4,148,259	.....	.....	.....	.....
.....	6,190	518,420	9,499	555,447	.....	.....	.....	.....
nesota, and					*			
.....	4,647	497,048	11,862	1,080,870	.....	.....	.....	.....
.....	10,232	1,252,719	11,656	1,406,317	.....	.....	.....	.....
.....	11,285	1,112,982	35,605	1,991,778	.....	.....	.....	.....
.....	18,402	1,428,738	37,596	2,487,753	.....	.....	.....	.....
.....	69,711	5,798,302	114,807	8,094,382	.....	.....	.....	.....
rginia, and a.....	123	8,544	600	42,000	.....	.....	.....	.....
.....	177,156	14,609,893	291,509	20,947,400	549,235	$42,537,158	588,691	.....

el castings produced by establishments not classified as "steel works and rolling mills": 1914, ued at ————; 1909, 44,379 tons, valued at $3,674,710; 1904, 4,184 tons, valued at $347,264.
clude Oregon and Washington.
clude Delaware ans Rhode Island.

Direct steel castings.

[Figures from Federal census.]

s.	1899		1904[1]		1909[1]		1914[1]	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
...	.....	.....	.....	.....	[2]	[2]	[2]	[2]
...	.....	.....	.....	.....	[2]	[2]	.....	.....
...	.....	.....	.....	.....	7,827	$671,485	[2]	[2]
...	.....	.....	.....	.....	74,613	5,715,421	103,523	$9,187,098
...	.....	.....	.....	.....	13,601	1,074,792	27,163	1,999,304
...	.....	.....	.....	.....	[2]	[2]	.....	.....
...	.....	.....	.....	.....	7,031	635,284	5,599	562,154
...	.....	.....	.....	.....	10,450	923,701	6,245	767,954
...	.....	.....	.....	.....	[2]	[2]	[2]	[2]
...	.....	.....	.....	.....	18,661	2,243,005	8,068	1,496,797
...	.....	.....	.....	.....	26,410	2,365,433	33,619	2,816,526
...	.....	.....	.....	.....	93,926	6,343,186	103,335	7,078,409
...	.....	.....	.....	.....	197,405	14,087,422	215,398	15,327,948
...	.....	.....	.....	.....	[2]	[2]	[2]	[2]
...	.....	.....	.....	.....	16,742	1,723,551	18,604	1,850,706
...	.....	.....	.....	.....	38,190	3,079,168	47,047	3,646,862
...	177,156	$14,609,893	287,325	$20,600,136	501,856	38,862,448	569,201	44,733,698

clude steel castings produced by establishments not classified as "steel works and rolling 9,490 tons, valued at ————; 1909, 44,379 tons, valued at $3,674,710. 1904, 4,184 tons, valued

"all other."

Alloy steel: Castings (not reported prior to 1909).

[Figures from Federal census.]

States or cities.	1909	1914	States or cities.	1909	1914
	Gross tons.	Gross tons.		Gross tons.	Gross tons.
Connecticut	(1)		Ohio		(1)
Delaware	(1)	(1)	Pennsylvania	1,589	4,439
Illinois		(1)	Wisconsin	(1)	29
Michigan	(1)		All other	419	7,199
New Jersey	4,900	(1)			
New York	8	(1)	Total	6,916	11,828

[1] Included in "all other."

Alloy steel castings.

[Figures from Annual Statistical Report of the American Iron and Steel Institute, 1919.]

	Gross tons.		Gross tons.
1909	23,002	1915	97,886
1910	29,357	1916	56,458
1911	56,290	1917	67,329
1912	103,109	1918	66,485
1913	88,927	1919	45,372
1914	69,846	1920	68,353

Steel castings by electric process.

[Figures from Annual Statistical Report of the American Iron and Steel Institute, 1919.]

	Gross tons.		Gross tons.
1909	306	1915	23,084
1910	1,320	1916	42,879
1911	1,878	1917	64,911
1912	4,162	1918	108,296
1913	9,207	1919	111,310
1914	8,551	1920	155,196

Domestic Exports.

Iron and steel, and manufactures of—Castings (not elsewhere specified).

[Fiscal years.]

Countries.	1910	1911	1912	1913	1914	1915
Belgium	$8,606	$3,492	$5,957	$10,490	$9,417	$518
France	26,080	16,445	29,440	43,171	55,012	5,501
Germany	37,672	37,833	29,059	64,313	23,800	1,143
Italy	10,465	45,863	35,122	17,825	19,020	15,990
Netherlands	5,067	2,794	7,752	10,238	18,119	694
Russia in Europe	5,034	6,337	14,819	11,628	25,521	6,098
Spain	5,543	5,851	6,414	8,016	24,574	2,813
United Kingdom	252,993	256,436	185,792	282,861	234,218	233,572
Canada	904,412	1,437,080	1,312,729	1,656,680	1,626,211	692,678
Panama	408,761	859,634	941,514	1,106,304	282,998	41,495
Mexico	168,665	249,448	137,614	75,379	32,489	19,333
Cuba	71,998	83,132	53,288	64,021	44,529	76,281
Argentina	21,374	7,958	10,063	8,388	22,535	6,894
Brazil	5,136	4,985	13,709	13,609	5,406	10,037
Chile	3,011	14,784	16,474	3,627	8,648	21,328
Peru	8,051	24,039	18,980	19,624	25,326	13,524
Japan	2,148	20,102	3,622	9,983	19,585	2,316
Australia	31,357	35,543	37,013	25,789	38,629	26,572
New Zealand	8,253	11,322	8,192	9,020	11,363	6,160
Philippine Islands	10,087	19,645	23,278	6,840	8,117	27,343
All other	66,315	71,004	73,640	116,208	96,390	77,441
Total	2,061,028	3,213,727	2,964,471	3,564,014	2,631,907	1,288,131

ron and steel, and manufactures of—Castings (not elsewhere specified)—Continued.

Countries.	1916	1917	1918	1918 [1]	1919 [1]
ance	$89,149	$370,166	$87,322	$466,882	$275,124
aly	31,377	89,834	70,621	204,744	122,178
rway	19,171	26,474	14,664	11,581	32,175
ssia in Europe	* 2,114	16,349	2,148	.....	.....
ain	2,979	20,415	11,101	6,296	16,477
ited Kingdom	860,353	4,946,990	290,292	149,202	89,148
nada	1,291,456	2,016,469	2,796,843	2,624,049	2,194,410
nama	93,711	95,338	22,490	25,038	37,533
exico	36,615	77,475	89,624	120,795	241,692
ba	98,209	222,568	190,924	218,387	402,359
rgentina	24,983	56,426	146,902	98,772	45,066
ile	157,950	159,555	64,326	161,293	79,771
ru	12,010	12,253	25,823	15,818	57,420
ina	17,693	6,030	14,965	42,932	52,449
hosen	926	32,454	8,986	11	2,158
itish India	9,291	18,175	51,130	51,649	167,199
utch East Indies	7,158	17,045	56,965	75,141	55,129
pan	7,477	70,461	89,711	65,359	170,467
stralia	77,602	51,204	21,219	15,953	29,820
itish West Africa	3,802	190	22,229	20,087	1,035
l other	138,649	209,766	187,273	161,564	436,434
Total	2,982,675	8,515,637	4,265,558	4,535,553	4,508,044

[1] Calendar years.

Rates of Duty.

Steel castings.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
		* * * all descriptions and shapes of dry sand, loam, or iron-molded steel castings, all of the above classes of steel not otherwise specially provided for in this act, valued at 4 cents a pound or less.	45 per cent ad valorem.
		Above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2½ cents per pound.
		Valued at above 10 cents per pound	3½ cents per pound.
	146	* * * all descriptions and shapes of dry sand, loam, or iron-molded steel castings; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{5}{10}$ cents per pound	$\frac{5}{10}$ cent per pound.
		Valued above $1\frac{5}{10}$ cents and not above $1\frac{7}{10}$ cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above $1\frac{7}{10}$ and not above $2\frac{5}{10}$ cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above $2\frac{5}{10}$ cents and not above 3 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 3 cents and not above 4 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	$2\frac{5}{10}$ cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$3\frac{5}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$4\frac{5}{10}$ cents per pound.
		Valued above 16 cents per pound	7 cents per pound.
	122	* * * all descriptions and shapes of dry sand, loam, or iron-molded steel castings; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{5}{10}$ cents per pound	$\frac{5}{10}$ cent per pound.
		Valued above $1\frac{5}{10}$ cents and not above $1\frac{7}{10}$ cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above $1\frac{7}{10}$ cents and not above $2\frac{5}{10}$ cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above $2\frac{5}{10}$ cents and not above 3 cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	$1\frac{5}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	$1\frac{5}{10}$ cents per pound
		Valued above 10 cents and not above 13 cents per pound	$2\frac{5}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{5}{10}$ cents per pound.
		Valued above 16 cents per pound	$4\frac{5}{10}$ cents per pound.
	135	* * * all descriptions and shapes of dry sand, loam, or iron-molded steel castings; * * * all of the above valued at 1 cent per pound or less.	$\frac{5}{10}$ cent per pound.
		Valued above 1 cent and not above $1\frac{5}{10}$ cents per pound	$\frac{5}{10}$ cent per pound.
		Valued above $1\frac{5}{10}$ cents and not above $1\frac{7}{10}$ cents per pound	$\frac{7}{10}$ centper pound.
		Valued above $1\frac{7}{10}$ cents and not above $2\frac{5}{10}$ cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above $2\frac{5}{10}$ cents and not above 3 cents per pound	$\frac{7}{10}$ cent per pound.
		Valued above 3 cents and not above 4 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound	$1\frac{5}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	$2\frac{5}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	$2\frac{5}{10}$ cents per pound.
		Valued above 16 cents per pound	$4\frac{5}{10}$ cents per pound.

Steel castings—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1909....	131	* * * all description and shapes of dry sand, loam, or iron-molded steel castings; sheets and plates and steel not specially provided for in this section, all of the above valued at ¾ cent per pound or less.	$\frac{1}{10}$ cent per pound.
		Valued above ¾ cent and not above $1\frac{1}{10}$ cents per pound.....	$\frac{1}{10}$ cent per pound.
		Valued above $1\frac{1}{10}$ cents and not above $1\frac{2}{10}$ cents per pound...	$\frac{2}{10}$ cent per pound.
		Valued above $1\frac{2}{10}$ cents and not above $2\frac{2}{10}$ cents per pound...	$\frac{2}{10}$ cent per pound.
		Valued above $2\frac{2}{10}$ cents and not above 3 cents per pound.....	$\frac{3}{10}$ cent per pound.
		Valued above 3 cents and not above 4 cents per pound.....	$1\frac{1}{10}$ cents per pound.
		Valued above 4 cents and not above 7 cents per pound.....	$1\frac{2}{10}$ cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	$1\frac{3}{10}$ cents per pound.
		Valued above 10 cents and not above 13 cents per pound.....	$2\frac{1}{10}$ cents per pound.
		Valued above 13 cents and not above 16 cents per pound.....	$2\frac{2}{10}$ cents per pound.
		Valued above 16 cents and not above 24 cents per pound.....	$4\frac{2}{10}$ cents per pound.
		Valued above 24 cents and not above 32 cents per pound.....	6 cents per pound.
		Valued above 32 cents and not above 40 cents per pound.....	7 cents per pound.
		Valued above 40 cents per pound.....	20 per cent ad valorem.
1913....	110	* * * all descriptions and shapes of dry sand, loam, or iron molded steel castings, * * *, all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, * * *, and similar alloys.	8 per cent ad valorem.
		* * * all descriptions and shapes of dry sand, loam, or iron-molded castings, * * *, all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, * * *.	15 per cent ad valorem.

STEEL BARS.

SUMMARY.

Steel bars are soft or medium merchant bars, usually not over 0.4 per cent carbon, and made by the Bessemer or open-hearth process. A special type is concrete bars. High carbon steel and alloy steel bars or bars manufactured from steel made by the crucible, electric, or cementation process are not included in this survey. Ordinary steel bars are rolled products made from billets, rarely made by forging. They are classified as rounds, flats, squares, hexagons, ovals, half rounds or half ovals, according to their section, and are larger than wire rods and wire of similar form. There is some overlapping in the trade between the sizes of flat bars and strips.

The production of steel bars is one of the most highly organized branches of the steel industry and no single product of any industry exceeds steel bars in quantity or value produced. In 1918, 5,395,851 tons of merchant steel bars were produced in the United States, having a value of $349,305,810 and constituting about one-eighth of the total domestic steel tonnage for that year. These figures, furthermore, do not include an output of 344,152 tons of steel bars for concrete reinforcement, which are, however, treated in this discussion. Domestic production has exceeded consumption for many years, and, due to the extensive additions to manufacturing plants during the war period, the American industry must maintain a large export trade in order to utilize its equipment to the best advantage. Immense amounts of capital are invested in the production of steel bars which constitute an outlet for a large volume of steel in self-contained works.

The industry for the most part is concentrated in a belt extending from New York and Baltimore on the Atlantic coast, westward through Buffalo, Pittsburgh, and Wheeling, and along the Great Lakes to Chicago. There are also large works at Birmingham, Ala., and at Pueblo, Colo.

The position of the United States in the world market is due to large-scale production made possible by the country's great resources in iron ore and coal. While the per diem rates of wages are higher in this country than in Europe, the output per man is also larger. In Europe new equipment has been installed in steel mills and production on a large scale is taking place. Wages in European countries as in the United States have advanced greatly since 1914. Foreign manufacturers, however, have been handicapped in recent years by the shortage of billets, the raw material from which steel bars are rolled.

While the American market has been comparatively free from foreign competition in recent years, American manufacturers encountered active competition in foreign markets before the war, especially from England and Germany. Due to the disorganization of international trade since 1914, American steel bars are now sold in many markets that were formerly British or German strongholds. Under present conditions, exports amount to from 10 to 15 per cent of home consumption. Since American steel bars are fully one-third

cheaper than those made in Great Britain exports are expected to continue. Belgian and German bars, however, were quoted lower than the prices asked by independent American producers at the end of 1920.

Steel bars are included in import statistics with various other products, some of which are doubtless more largely imported than steel bars. Nevertheless, assuming these statistics refer only to merchant steel bars, the quantity imported in 1914 was about 1 per cent of the domestic output and in 1918 the ratio had dropped to only 0.1 per cent.

The duties on steel bars were materially lowered in the act of 1913, when ad valorem instead of specific rates were adopted. The specific duties under the act of 1909 were on a sliding scale, averaging about 35 per cent, as compared with 8 per cent under the act of 1913.

Under the act of 1913 the 8 per cent duty provided for ordinary merchant steel bars made of Bessemer or open-hearth steel not containing alloys covers both steel bars which are not further advanced than hot-rolled and those which are cold-rolled or machined. Certain high-grade tool steels which have undergone an expensive process of heat treatment made of Bessemer and open-hearth steel are also dutiable at 8 per cent ad valorem. On the other hand, bars manufactured out of steel made by the duplex or triplex process, being finished in electric furnaces, are classified with bars dutiable at 15 per cent ad valorem, although often not more costly than similar bars made in open-hearth furnaces.

Summary.

Fiscal year.	Domestic production.[1] [4]	Imports for consumption.[2]	Domestic exports.	Ratio to production (per cent).	
				Imports.	Exports.
	Long tons.	*Long tons.*	*Long tons.*		
1910	2,711,568	.....	90,500	.....	3.34
1911	2,211,737	.....	122,847	.....	5.55
1912	2,752,324	.....	146,045	.....	5.31
1913	2,930,977	.....	231,091	.....	7.88
1914	1,960,460	[3] 21,566	149,113	1.10	7.61
1915	3,474,135	17,832	230,275	.51	6.63
1916	5,236,354	8,193	625,586	.16	11.95
1917	5,226,031	6,859	749,981	.13	14.35
1918	5,395,851	6,097	612,742	.11	11.36
1918 [4]	5,395,851	4,388	579,249	.08	10.74
1919 [4]	3,945,075	5,191	554,211	.12	14.05
1920 [4]	5,467,208	10,279	629,051	.....	.....

Fiscal year.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity (pound).	Equivalent ad valorem rate.
				Per cent.
1914	[3] 814,778	$65,182.28	$0.017	8.00
1915	714,590	57,167.20	.018	8.00
1916	721,012	57,680.96	.039	8.00
1917	831,764	66,541.12	.054	8.00
1918	822,651	65,812.08	.060	8.00
1918 [4]	468,451	37,476.08	.048	8.00
1919 [4]	572,268	45,781.44	.049	8.00
1920 [4]	1,353,892	108,269.04	.059	8.00

[1] Does not include concrete reinforcing bars.
[2] "Bars or rods of steel" not listed separately before 1914.
[3] Oct. 4, 1913, to June 30, 1914.
[4] Calendar year.

General Information.

TARIFF ACT OF 1913, PARAGRAPH 110, 8 PER CENT AD VALOREM.

Steel bars * * * if made by the Bessemer, Siemens-Martin, or similar processes, not containing alloys * * * 8 per cent ad valorem.

DESCRIPTION.

Steel bars are finished products of rolling mills,[1] made of steel which may be distinguished from wrought iron by reason of the process by which it is made and by its freedom from slag and from cast iron on account of its lower content of carbon and silicon, and the method of manufacture), and of considerable length with respect to the dimensions of their cross section.

They may be classified as to their carbon content into (*a*) *mild* or *soft* (less than about 0.22 per cent carbon), (*b*) *medium* (approximately 0.2 to 0.3 per cent carbon), and (*c*) *hard* (over about 0.3 carbon and often containing various special alloying elements). Most of the hard-steel bars are special steel, generally made by the crucible process or in the electric furnace and are treated in separate surveys.[2] Only soft and medium steel bars are here considered as made by the Bessemer or open-hearth processes and not containing alloys. The official classification of steel bars according to section and the common sizes as adopted by the American Iron and Steel Institute are as follows:

Rounds and squares, from $\frac{3}{16}$ inch up to $7\frac{1}{4}$ inches.

Flats, 1 by $\frac{3}{8}$ inch up to 6 by 4 inches.

Hexagons, $\frac{1}{4}$ inch to 3 inches.

Half rounds, $\frac{3}{8}$ inch to 3 inches.

Half ovals, 1 to 4 inches wide and $\frac{1}{4}$ inch or more thick (also $\frac{3}{8}$ to $\frac{7}{16}$ inch wide and Nos. 14 or 15 B. W. G.).

Ovals, $\frac{3}{4}$ to $2\frac{1}{2}$ inches wide and $\frac{3}{8}$ inch or more thick; also $\frac{3}{8}$ to $\frac{7}{16}$ inch wide and $\frac{3}{32}$ inch or more thick. (This classification of ovals is not followed by the Treasury Department which established.—T. D. 34694—as steel bars those "over $\frac{3}{16}$ by 7 inches and under."

Rods are round bars, a special variety being wire rods, which are round bars having a section of 0.2 to 0.3 inch in diameter and coiled in bundles. According to Court and Treasury Decisions, sections thinner than 0.203 inch in diameter (No. 6 B. W. G.) are classed as wire. Hoops, cotton ties, and band iron generally, together with strips and skelp, are distinguished from flat steel bars in that they are thinner in proportion to their width. Shapes resemble steel bars in many respects but have a more or less irregular section. All the above are treated in other Tariff Information Surveys and are therefore not included in this unit.

Steel bars are one of the most important commercial products, both as regards the variety of their uses and the value of the output. They are employed for a multitude of purposes, among which may be mentioned blacksmithing, nuts, spikes, bolts, horseshoes, chain, structural work, concrete reinforcement, and machinery.

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[1] Steel bars were formerly made by hammering, but the tonnage of merchant bars now made by forging in the United States is absolutely negligible.

[2] Surveys on Alloy Steel and Tool Steel.

The only general substitute is bar iron (wrought iron), which is softer, purer, more resistant to shock and rust, and more easily welded; but it is a handmade product of limited output and more costly.

DOMESTIC PRODUCTION.

The domestic production of steel bars more than doubled in 10 years, increasing from 2,311,301 tons in 1909 to 5,395,851 in 1918.[2] In 1919 the country's output was 3,945,075 long tons, and in 1920, 5,467,208 long tons. Steel bars form one of the largest single items among the finished products of the iron and steel industry, amounting to approximately 18 per cent of the total tonnage and a larger percentage of the total value of iron and steel products. The increase in plant capacity for making steel bars was 27 per cent in the three years 1915–1917.[3]

Materials.—The raw material for making steel bars is steel in the form of billets, which are themselves a semifinished rolled product of the steel industry. While billets form an article of commerce even in the United States, they are not generally bought by domestic rolling mills which in this country are largely self-contained. With few exceptions rolling mills are integrated to the extent that the manufacture of steel bars from liquid steel is carried on in the same plant, frequently in one heat.

For this reason the raw materials actually delivered at the plants are those required in the manufacture of pig iron or steel, but the conditions surrounding the supply of these commodities have been discussed in detail in other tariff information surveys on intermediate products (steel ingots, blooms, and billets). The following estimate of the primary raw materials required to produce 5,000,000 tons of steel bars, however, is given here, as it includes the losses:

Raw material:	Estimated tons.
Iron ore	5,000,000
Limestone	2,000,000
Coal	[4] 5,500,000
Scrap	2,500,000
Ferromanganese	50,000

Equipment.—Steel bars are rolled from heated billets in merchant bar mills. For small reductions, a single pair of rolls (two high, nonreversing) of a diameter of 16 to 20 inches is sufficient in each unit of the plant. Small sizes are finished in small merchant bar mills with final rolls from 8 to 16 inches in diameter. The rolls in all cases are grooved so as to confine the metal on all sides, the shape of the grooves depending upon the form of section (rectangular, round, oval, etc.) produced.

Accessory equipment includes transfer tables, shears, cooling beds, etc., and, in modern works, the merchant bar mills are the last in a continuous train of rolls which reduce the width and thickness and consequently increase the length of the steel through the successive stages from the ingot as delivered from the soaking pit to the final bar. The usual equipment, therefore, includes that of the ordinary American steel plant, which is heavy, costly, and largely automatic in operation. It is almost exclusively of domestic manufacture and

[2] The 1908 output was only 1,301,405 tons, and is not comparative owing to the reduced production after the panic of 1907.
[3] U. S. Geological Survey Bulletin 666-V.
[4] Not including coal used in transportation of raw materials and products.

design, and can be obtained fully as cheaply in the United States as in foreign countries.

Methods of production.—As indicated above, steel bars are generally made in the United States by the continuous process. The various stages of reduction are carried on so rapidly that the initial heat is preserved, thereby obviating the necessity of placing the sections in furnaces in order to bring the metal back to the requisite red heat.

The best American ingenuity has been directed toward eliminating the human labor involved in the rolling mills as well as toward saving fuel. Extraordinary progress has been made and in modern plants the ingot is reduced almost automatically, labor being employed only to keep the electrically driven and synchronized machinery running continuously. Great economies in fuel and labor have been effected as a result of the production of enormous quantities in single units of plant. Well-paid male labor is employed exclusively in American mills. Formerly there was a much larger amount of unskilled foreign labor required, but rising wages have resulted in the substitution of mechanical devices for human labor to a remarkable degree.

Organization and geographical distribution.—The steel industry ranks first among all industries in the number of large, highly integrated establishments, and the manufacture of steel bars is fully abreast of the specialization and standardization achieved in the other branches of the industry.

The extent to which integration has progressed in the United States is shown by the following recent data as to steel works and rolling mills: 64.7 per cent are equipped with steel furnaces and hot rolls; 4.3 per cent are equipped with steel furnaces but no hot rolls; 31 per cent are equipped with hot rolls, but no steel furnaces.

The above statistics refer to the number of plants; on the basis of actual output, the percentage in the first group is very much greater. Most of the first group also have iron blast furnaces operated in conjunction with coal and iron mines and limestone quarries.

According to the Annual Statistical Report of the American Iron and Steel Institute for 1920, steel merchant bars were rolled by 186 works in 27 States in 1920, as compared with 170 plants in 27 States in the preceding year. Bars for concrete reinforcement work were rolled in 69 works in 20 States in 1920, Pennsylvania furnishing 16.23 per cent of the total output; California, 12.75 per cent; New York, 10.82 per cent; and Indiana, 19.50 per cent. There is no statement as to the extent of overlap in the above figures, since both merchant bars and concrete bars are made in the same plants. These figures also do not indicate the number of financial groups in the industry, since several establishments are owned by single interests.

History.—The history of the production of steel bars is closely linked with the advances made in the manufacture of Bessemer and open-hearth steel and in the development of steel rolling mill practice and organization. The special feature is the increasing substitution of mild steel bars for the more costly wrought iron which has now been largely displaced except for special purposes. Electric steel is the most important modern development.

Domestic production and consumption.—The production of steel bars in 1920 was 5,467,208 tons, which was considerably in excess of domestic consumption. In addition to this output there were

571,747 tons of steel concrete bars produced. About 12 per c of the domestic output was exported. Imports were negligi amounting to less than 11,000 tons.

The total mill capacity is considerably in excess of producti which has been limited by curtailment of demand after the w by strikes, transportation difficulties, and the like.

Domestic exports.—The Department of Commerce in its exp statistics distinguishes only two classes of steel bars and rods, viz, "w rods" and "all other." The statistics given below refer to the lat classification which, in addition to merchant bars, includes concr bars, nut and bolt rods, etc., which are not included in the producti figures given above.

The exports of steel bars in the fiscal year 1913 amounted to mo than 250,000 tons, valued at $8,386,322, which is the largest record in the prewar period. In the 12 months immediately preceding t outbreak of the war in Europe, less than 170,000 tons were exporte but this is an increase as compared with 1912, and indicates a gradu growth in the export trade. Before the war Canada was the ch market. The extraordinarily large exports in 1913 went mainly England, Canada, and Japan.

The exports of steel bars increased rapidly during the war peri as a result of the European demand and the withdrawal of Germa and England from the export trade. The maximum exports were the fiscal year 1917, when they reached 840,000 tons, valued at mo than $55,000,000 (a result chiefly of French requirements, althoug there were greatly increased shipments to Canada, Italy, Englan and Japan). In 1918 the exports declined slightly, due to the d mestic needs, and a further drop was registered in 1919, when the amounted to 620,716 gross tons. European countries are not ye (1920) in a position to export on a very large scale. While thei domestic needs have been more nearly supplied by their own output they have not been able to resume exports on the prewar scale. Soutl American and Eastern markets have looked mainly to the Unite States for their supplies of all classes of iron and steel, although Bel gium and Germany in July, 1921, were competing actively with thi country in the world's markets.

FOREIGN PRODUCTION.

Steel bars are rolled in all the great steel-producing countries, th most important foreign producers being the United Kingdom, France Germany, and Belgium. Sweden and Russia are more important a producers of wrought iron than of steel bars. Statistics of foreign production of steel bars are not generally available, but the relativ importance of the different countries is probably the same as that o their productions of steel ingots which, after the war, can be taken in the order in which they are named above.

The United Kingdom, next to the United States, is probably th largest producer of steel bars in the world, but is closely followed by France, which in 1919 reported an output of 538,386 tons of "mer chant and special steel," most of which doubtless consisted of mer-

ınt bars.[6] The production of "general merchant steel" in Great itain in recent years is given in the following table:[7]

	Tons.		Tons.
5	534,503	1917	523,437
6	523,546	1918	517 194

All the European countries are facing serious difficulties in regard fuel, labor, and transportation, which are reflected in a general ortage of billets. While wages, in spite of war advances, are still wer than in the United States, the labor costs in practically all uropean plants are manifestly higher than in the average American lling mill, due to the smaller units, less highly developed organiza- on, and more limited resources in ore and coal. Consolidations are ogressing rapidly, however, especially in Great Britain, where roll- g mills are being installed at various steel plants, and several roll- g mills that formerly either purchased their billets or rolled bars d other shapes on a royalty basis have added steel furnaces and e more or less self-contained. The new equipment installed in ngland is up to date and efficient, comparing favorably with most merican plants, and production methods are being copied from merican practice.

Aside from the question of organization, the supply of raw material, hether in the form of cold or hot billets, is the main consideration. ll the European producers have imported American billets and gots since the war; and prior to 1914 England, and to some extent rance and Belgium, supplemented their supply by imports from rmany. Late in 1920 England again imported considerable quan- ies of billets from Belgium.

Canada is of increasing importance as a steel-producing country, d there was a rapid growth in the output of all classes of finished lled products (except rails) during the war period. The statistics production of merchant bars in Canada are not given separately the American Iron and Steel Institute, but are included with ates and sheets, tie-plate bars, and minor products. The com- ned production of these articles increased from 218,125 tons in 14 to 714,021 tons in 1918. The production of all classes of finished led products, which also includes rails and structural shapes and re rods, was 659,519 tons in 1914 and 1,001,308 tons in 1918. In 18, 24 Canadian works rolled finished forms of iron and steel. e expansion of the steel industry in Canada, however, has not been fficient to satisfy the domestic requirements, as evidenced by the ntinued importation of steel bars and nail rods in large quantities. e supplementary supply now comes almost wholly from the United ates, whereas before the war over 10 per cent of the trade was ared by Great Britain, Germany, and Belgium.

IMPORTS.

The import figures in Commerce and Navigation embrace "bars d tapered or beveled bars" (merchant bars) manufactured out steel made by the Bessemer and open-hearth processes. Formerly y included a variety of other steel products. In the calendar

[6] Commerce Reports, July 8, 1920.
[7] Statistical report, 1918. National Federation of Iron and Steel Manufacturers (British).

year 1919 the imports amounted to 11,627,086 pounds (5,190 l tons) valued at $572,268. The ratio of aggregate imports to t domestic production was less than two-tenths of 1 per cent.

The imports of steel bars by countries are not separately listed the publications of the Bureau of Foreign and Domestic Commer but are grouped with those of mill shaftings and castings. Nea all of this importation came from Canada, Sweden, and the Uni Kingdom in 1919, the first of these countries furnishing between and 80 per cent of the total.

The prewar imports of iron bars, valued at about $1,000,000 a nually and derived largely from Sweden, do not compete with Ame can steel bars but with the best grades of American wrought-ir bars. They are used largely as raw material in the manufactu of crucible steel.

PRICES.[8]

Following the panic of 1893, the price of steel bars dropped t cent a pound, but with the recovery of business steel bars w quoted at $1.50 per 100 pounds in 1899, and this level was mai tained as a fair average quotation until 1911, in which year the pr dropped from $1.40 to $1.08 in 7 months. A gradual recove brought the quotation to a maximum of $1.85 in March, 1913. June and July, 1914, steel bars were selling for $1.11 and $1. rising to $1.20 in September, but falling again to $1.07 in Decemb

Under the influence of war orders, the price increased rapidly 1915 and, except for a slight depression in the summer of 1916, t advance continued steadily until July, 1917, when the avera quotation for the month was $4.50 per 100 pounds at Pittsburg A maximum price of $2.90 was fixed under Government auspic September 24, 1917, and this was maintained until after the arm stice. In 1919 the price of $2.35 was adopted by the industri board (Department of Commerce) in conference with represent tives of the industry. The list was not approved by the Railro Administration, and hence in the fall when production was restricte the independent producers raised their prices. The United Stat Steel Corporation, however, maintained this price, although it w able to make only distant deliveries. Spot quotations in July we $4 and with business done on three or four months, futures by ind pendent mills as low as $3. In December, 1920, the price had d clined to $2.35 per 100 pounds.

Foreign prices for a year or more after the war averaged muc above American prices not only in terms of the depreciated curre cies but in American dollars. Of European countries, Great Brita is most favorably situated at the present time, but there the price steel bars in January, 1920, was £27 per gross ton, or nearly $3. per 100 pounds (exchange at $3.50), as compared with the Ame can price of $2.75. In July, 1920, the British price (£28–£29 14 was equivalent to between $4.90 and $5.90 per 100 pounds (e change at $3.94) according to size, which is over 50 per cent mo than the Pittsburgh quotation. During the war period, howeve the British fixed price (£15 per ton), which applied to domest

[8] All domestic quotations used in this discussion are on the Pittsburgh base, i. e., f. o. b. mill Pittsbu Philadelphia and New York quotations are generally 5 cents or more higher.

sales but not to export, was lower than the American maximum, but toward the end of the war period there was a Government subsidy of 10s. per ton, or $1.05 per 100 pounds.

In December, 1920, steel bars were selling in England at £22 ($77), Germany at 2,440 marks ($32.50), in Belgium at 825 francs ($52), and in France at 1,200 francs ($72). The American price, equivalent to $80.64 per ton, as quoted by the independents, is higher than any of the above and even the Steel Corporation's quotation ($52.34) was considerably higher than the German price. In the early part of January practically all the independent American companies had come down to the Steel Corporation's price of $2.35 per 100 pounds, although it was claimed that this was lower than the cost of production in the smaller plants, in spite of wage reductions of from 25 to 35 per cent. Prices were further reduced until in July, 1921, bars were quoted in Pittsburgh as low as $1.90 per 100 pounds.

TARIFF HISTORY.

Since 1890 the duties on steel bars have been generally reduced. The act of 1913 substituted ad valorem for specific rates, and with the prices prevailing when that act was passed the reduction was pronounced. At the prices quoted in the fall of 1913 the reduction was approximately equivalent to one from 35 per cent to 8 per cent. The great increase in prices during the war period greatly modified this reduction.

In our tariff laws steel bars have been grouped with a variety of other steel products though distinguished from iron bars, which were separately provided for. The different classes of products were to a degree distinguished by sliding scales of specific duties in the tariffs of 1890 to 1909, inclusive. In the latter act the range extended from three-fourths cent per pound (or less) to over 40 cents per pound. Steel valued above the latter figure was dutiable at 20 per cent, whereas the specific duties were equivalent to over 40 per cent on the cheaper classes.

American duties since 1890 are given in detail infra.

COMPETITIVE CONDITIONS.

The domestic market in steel bars has been comparatively free from foreign competition for many years, and before the war American bar steel was exported to many parts of the world, successfully competing with British and German steel. The war resulted in a complete disorganization of the international trade in iron and steel, and many markets, formerly held by other great exporting nations, have fallen to the United States owing to the world shortage. Germany, formerly a great exporter, has been short of steel since the war, and reconstruction in France and Belgium has absorbed local outputs which have been supplemented by shipments from Great Britain and the United States. Practically the only competitor of the United States in foreign markets since the war has been the United Kingdom, and prices in that country have been far above American levels. With the partial recovery of the iron and steel industry in Belgium, Germany, and France, however, active competition developed in the British market, with the result that in January, 1921, the prices of

many commodities came down to under those charged in the United States.

While active foreign competition in the American market may not develop for some time, it should be noted that American wages are much above those paid in foreign countries, and the relatively low costs of American iron and steel are the result solely of American ingenuity and organization applied to the production of these products in the huge units and on the extensive scale made possible by a great home market. The domestic productive capacity has been greatly increased, and now foreign markets are needed to insure full-time operation.

Other nations whose wage scales are still considerably lower than the American standards in spite of the greater perce tage (in some cases) of increase have now clearly recognized thnesecret of the American advantage, and American production methods have been copied, especially along the lines of rolling-mill practice. Europe is handicapped by the higher cost of raw materials, resulting from the disorganization of transportation, labor difficulties, and the resultant shortage of fuel following the war. In January, 1921, these difficulties are being rapidly surmounted as evidenced by increased exports from continental producers who have invaded the British market, which until late in 1920 had been subject only to American competition which was directed chiefly to other countries. These changes are merely a phase of the steel situation which is discussed in detail in other surveys. France, with ores obtained from Germany, and cheap hydroelectric power, may greatly increase production of electric steel bars.

In the early years of its history the production of steel bars had to meet the competition of bar iron manufacture, but since wrought iron is made by processes involving a large amount of highly skilled and arduous manual labor, and the manufacture of steel bars is mainly a matter of mechanical equipment, bar iron is now more costly and is used only for special purposes.[9]

The extent to which mechanical equipment and organization determines the cost of producing steel bars is shown by the cost sheets of the War Industries Board covering the operations of 24 companies in the United States, producing a total of 381,689 tons. The lowest cost in 1918 was $41.77 per ton, highest $86.26, average $76.24. Both the highest and the lowest cost mills were self-contained organizations, yet one was able to make its product for less than one-half the cost of the other mill.

The Federal Trade Commission, in the determination of costs of iron and steel products during the war for the use of the price-fixing committee of the War Industries Board and of certain purchasing departments of the Government, obtained the monthly cost sheets of the producing companies showing the average mill costs of producing merchant bars from October, 1917, to December, 1918, inclusive. These cost sheets were for the mill costs and did not cover general and administrative expenses or general depreciation. At the request of the Tariff Commission for information respecting the proportion of the various items of costs to the mill cost, the Federal Trade Commission compiled the costs as reported by five representative companies. They did not, of course, include any items for

[9] Comparative prices of bar iron and steel bars (yearly averages) since 1897 will be found on page 22.

for income or excess-profits taxes. If the additional costs
l and administrative expenses and for general depreciation
determined with accuracy there would be a substantial
o the mill cost as shown below.
ata have not as yet been published by the Federal Trade
on and were furnished to the Tariff Commission with the
that they were subject to revision. While these figures
ported mill costs for only five companies, it is believed that
ufficiently representative to show the relative importance
ticular items entering into the mill costs. For quarterly
ese costs were as follows:

f. o. b. furnace of merchant bars, exclusive of general and administrative nd depreciation, of 5 representative companies, by quarters, for the period 17, to December, 1918.

[Per gross ton.]

tems of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	October to December.
	$1,219,164	$805,047	$1,019,701	$904,288	$885,337
	36.12	37.81	36.00	38.93	41.82
	.46	.57	.45	.49	.52
	3.17	3.44	3.75	3.90	4.48
d repairs	.84	.91	.90	.99	1.21
	.38	.29	.30	.37	.45
er	.78	.79	.64	.65	.66
contingent	.07	.11	.10	.09	.08
	1.33	1.68	1.50	1.72	2.01
cost	43.15	45.60	43.64	47.14	51.23
PER CENT OF MILL COST.					
	83.71	82.92	82.49	82.59	81.63
	1.07	1.25	1.03	1.03	1.02
	7.35	7.54	8.59	8.27	8.74
d repairs	1.94	2.00	2.06	2.10	2.36
	.88	.64	.69	.78	.88
er	1.81	1.73	1.47	1.38	1.29
contingent	.16	.24	.23	.19	.16
	3.08	3.68	3.44	3.66	3.92
	100.00	100.00	100.00	100.00	100.00

e observed that over 80 per cent of the total mill cost of
ring merchant bars (or steel bars) consists of the elements
n the net metal item. About one-half of the conversion
resented by labor.

TARIFF CONSIDERATIONS.

rimarily designed to cover the different classes of products
the paragraphs with steel bars, the sliding scales of the
iff acts operated in the case of steel bars so as to yield a
ecific duty on heat-treated and machined steel in the form
l on alloy steels. Alloy steels are specifically provided for
nd part of paragraph 110 of the 1913 act and dutiable at
d valorem rate (15 per cent), and this rate also applies to
made by the crucible, electric, or cementation process,

whether containing alloys or not. Most tool steels are made by one of the latter processes, but it is now possible to produce a very high quality of steel in the open hearth, and when heat treated some of this steel competes with that made by the crucible process or in the electric furnace. The price is generally lower than that of the steel made by a more expensive process. Another special consideration is a high quality of steel made in Sweden from extraordinarily pure raw materials by the Bessemer process,[10] which it is claimed is the equal of the best steel made by the crucible method or in the electric furnace. This product in the form of bars would also come under the lower duty of 8 per cent instead of the higher rate imposed on bars made of crucible or electric steel.

Another development is the manufacture of merchant steel bars from steel made by a duplex or triplex process, including a final treatment in the electric furnace. Such bars, frequently no higher priced, could be classed under the higher rate, though competing with the product now dutiable at 8 per cent.

Cold-rolling, machining, and other mechanical advancements in addition to hot-rolling also deserve consideration in the phrasing of the tariff act, but this matter will be discussed in the Tariff Information Survey on Shafting.

Production in United States.

STEEL BARS.

[From Federal census.]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Tons.			*Tons.*	
1900 [1]	2,493,159	$100,597,221	1909	3,784,248	121,488,[illegible]
1904 [1]	2,442,810	84,069,122	1914 [2]	2,474,737	84,409,[illegible]

[1] Includes bars for reinforced concrete.
[2] Merchant bars (including bars or rods n. e. s.).

STEEL MERCHANT BARS.

Year.	Gross tons.[1]	Year.	Gross tons.[1]
1905	2,271,162	1913	2,930,977
1906	2,510,852	1914	1,960,[illegible]
1907	2,530,632	1915	3,474,[illegible]
1908	1,301,405	1916	5,236,[illegible]
1909	2,311,301	1917	5,226,031
1910	2,711,568	1918	5,395,831
1911	2,211,737	1919	3,945,070
1912	2,752,324	1920	5,467,[illegible]

[1] Annual Statistical Reports, 1918 and 1919, Am. I. and S. Inst.

CONCRETE STEEL BARS.

[From Annual Statistical Report, 1919, American Iron and Steel Institute.]

Year.	Long tons.	Year.	Long tons.
1909	159,352	1915	353,[illegible]
1910	236,464	1916	455,717
1911	256,353	1917	469,687
1912	271,832	1918	344,152
1913	319,557	1919	416,726
1914	288,471	1920	572,445

[10] This subject is also discussed in the Survey on Steel Ingots. The carbon is "caught coming down," a difficult matter, but done successfully in this instance.

Steel bars—Production in United States, by States.

[From Federal census.]

States.	1890 [1]		1904 [1]	
	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*	
Pennsylvania	1,036,759	$43,453,494	1,166,234	$40,421,670
Ohio	472,159	17,787,412	274,191	8,672,661
Illinois	197,190	6,374,298	145,527	4,732,538
Indiana	191,605	7,754,600	212,421	6,716,752
Wisconsin	115,952	3,721,171	.....	.....
New York	.....	.....	.....	.....
All other	479,493	21,496,246	644,437	23,525,501
Total	2,493,159	100,597,221	2,442,810	84,069,122

States.	1909		1914 [2]	
	Quantity.	Value.	Quantity.	Value.
	Gross tons.		*Gross tons.*	
Pennsylvania	1,749,220	$56,717,882	1,187,216	$41,520,566
Ohio	704,168	21,168,583	299,957	10,784,382
Illinois	455,209	13,952,608	235,853	6,820,357
Indiana	231,851	7,540,757	441,629	12,492,482
Wisconsin	.....	.....	.....	.....
New York	101,799	4,007,714	.....	.....
All other	542,001	18,100,879	310,082	12,791,713
Total	3,784,248	121,488,423	2,474,737	84,409,506

[1] Includes bars for reinforced concrete.
[2] Merchant bars (including bars or rods n. e. s.).

Bar steel (statistics not available for bar steel)—Production in principal foreign countries of all kinds of steel.

Countries.	1913	1916	1917	1918	1919
Germany: [1]	*Metric tons.*	*Metric tons.*	*Metric tons.*	*Metric tons.*	*Metric tons.*
Basic Bessemer	10,629,697	7,653,990	7,294,899	5,906,460	.....
Open-hearth	7,610,140	6,856,801	7,274,473	6,170,781	.....
Acid Bessemer	155,138	175,109	173,430	146,424	.....
Crucible	99,173	108,205	129,784	79,064	.....
Electric	101,755	190,036	219,700	221,824	.....
Steel casting	298,338	1,198,379	1,495,074	1,232,260	.....
Total	18,894,241	16,182,520	16,587,360	13,756,813	.....
France:					
Acid Bessemer	252,704	69,794	63,630	79,596	48,682
Basic Bessemer	2,806,475	513,529	574,150	315,041	1,012,916
Open-hearth	1,582,478	1,290,533	1,498,353	1,312,625	1,070,166
Crucible and electric	43,209	77,736	94,518	100,669	59,496
Total	4,686,866	1,951,892	2,231,651	1,807,931	2,186,260
Sweden:					
Bessemer	.....	.....	76,900	66,500	56,900
Open-hearth	.....	.....	489,700	458,300	412,400
Census, 1915	4,900,000	.....	.....	.....	.....
Great Britain: [1]	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Basic Bessemer	551,929	505,817	602,265	567,650	.....
Acid Bessemer	1,048,772	1,096,153	1,059,281	788,355	.....
Acid open-hearth	3,811,382	4,393,004	4,413,843	3,901,136	.....
Basic open-hearth	2,251,793	3,012,558	3,421,170	3,924,415	.....
Electric	.....	.....	57,156	103,021	.....
Total	7,663,876	9,196,457	9,553,715	9,284,577	7,894,000

[1] Mineral industry, 1919.

Steel bars—Imports by countries (fiscal years).

Not given separately. Ingots, blooms, slabs, billets, and bars of steel and steel in forms n. e. s. given together. Imports of above were in 1914 from Belgium, Germany, England, Sweden, and in 1918 from England, Sweden, Canada, Mexico.

Steel bars and tapered or beveled bars, etc.[1]—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914[2]	8 per cent ad valorem.	48,307,496	$814,778.54	$65,182.28	$0.017	8.00
1915	do	39,943,425	714,500.00	57,167.20	.018	8.00
1916	do	18,353,080	721,012.00	57,680.96	.039	8.00
1917	do	15,365,018	831,704.00	66,541.12	.054	8.00
1918	do	13,656,562	822,651.00	65,812.08	.060	8.00
1918[3]	do	9,829,641	468,451.00	37,476.08	.048	8.00
1919[3]	do	11,627,086	572,268.00	45,781.44	.049	8.00
1920[3]	do	23,016,748	1,353,363.00	108,269.04	.059	8.00
1920[3 4]	Duty remitted: Section IV, J5.	8,140	529.00		.065	

[1] Prior to 1914 steel bars are included with "Steel ingots, cogged ingots, * * *," etc.
[2] Oct. 4, 1913 to June 30, 1914, under act of 1913.
[3] Calendar year.
[4] For the construction and equipment of vessels.

Steel bars or rods of steel—Domestic exports.

[Fiscal years.]

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Germany	937,842	$16,077	7,209,371	$129,833	3,994,970	$75,[illegible]
United Kingdom	12,098,855	200,837	10,277,911	241,570	16,309,878	347,[illegible]
Canada	150,101,844	2,390,235	184,586,097	2,822,424	190,431,749	2,839,[illegible]
Cuba	3,167,214	59,455	5,267,368	99,941	23,845,351	351,[illegible]
Panama	5,285,253	108,986	10,010,319	165,980	8,817,069	130,[illegible]
Japan	608,511	16,186	4,486,024	81,877	21,970,952	449,[illegible]
Australia	8,092,929	134,231	9,306,569	154,841	7,153,686	116,[illegible]
Philippine Islands	5,517,834	93,299	14,895,124	253,541	20,768,376	451,[illegible]
Chile	582,823	12,119	8,692,415	146,960	11,261,637	183,[illegible]
France	174,640	4,510			132,176	2,[illegible]
All other	16,165,304	342,537	20,525,821	386,738	22,455,153	426,[illegible]
Total	202,734,049	3,468,473	275,178,019	4,486,705	327,140,997	5,393,[illegible]

Exported to—	1913		1914		1915	
	Quantity.	Value.	Quantity.	Value	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Germany	7,732,237	$162,371	2,635,076	$74,814	63,029	$1,[illegible]
United Kingdom	106,851,103	1,539,793	24,921,332	488,406	130,053,036	1,867,[illegible]
Canada	249,523,144	3,921,471	185,584,537	3,019,274	134,293,895	2,111,[illegible]
Cuba	27,101,129	426,402	25,250,958	402,259	22,141,085	265,[illegible]
Panama	8,997,961	150,679	15,245,830	287,010	6,107,406	91,[illegible]
Japan	41,594,861	734,530	4,087,576	91,834	30,975,780	807,[illegible]
Australia	18,317,604	280,946	7,576,403	133,348	28,930,555	416,[illegible]
Philippine Islands	13,680,519	339,761	21,655,394	446,254	11,649,716	212,[illegible]
Chile	12,281,617	206,922	14,534,382	237,414	6,492,118	90,[illegible]
France	168,283	3,429	31,494	673	79,031,625	1,500,[illegible]
Italy					48,095	[illegible]
All other	31,395,481	620,018	32,491,117	587,707	66,028,662	1,009,[illegible]
Total	517,643,939	8,386,322	334,013,099	5,768,993	515,815,062	8,083,[illegible]

Steel bars or rods of steel—Domestic exports—Continued.

[Fiscal years.]

ed to—	1916		1917		1918	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
dom	244,919,707	$4,667,792	173,119,676	$5,703,389	88,802,648	$4,170,067
	253,991,328	5,321,000	308,824,865	11,205,142	286,123,576	13,385,264
	27,394,329	471,256	39,071,641	1,196,890	17,785,667	744,390
	9,832,865	182,068	10,782,111	343,344	7,868,001	324,276
	185,456,358	4,176,903	288,385,127	8,864,174	475,317,447	25,735,399
	54,401,855	928,935	45,076,258	1,107,039	11,499,803	505,550
lands	16,217,484	316,779	6,647,933	253,195	19,071,275	1,057,537
	5,536,164	107,591	18,266,362	709,897	28,136,509	1,395,118
	426,625,382	11,885,756	463,999,210	14,586,929	109,814,518	4,434,500
	7,424,405	183,066	162,673,832	5,479,245	139,010,818	6,873,283
	169,512,141	3,368,955	163,110,311	5,636,345	189,090,516	10,176,597
	1,401,312,018	31,610,101	1,679,957,326	55,085,589	1,372,520,778	68,801,981

[Calendar years.]

ed to—	1918		1919		1920	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
dom	57,116,682	$2,761,665	152,840,510	$5,725,920		
	353,124,391	15,801,094	147,666,436	6,250,233		
	15,816,280	638,189	29,290,696	1,105,052		
	3,837,650	155,846	5,226,725	170,153		
	427,186,176	22,516,142	328,880,120	11,217,912		
	6,582,415	334,957	9,765,735	448,474		
lands	14,327,827	810,439	20,036,961	829,879		
	14,978,290	813,525	20,055,178	820,898		
	84,978,827	3,531,265	180,139,978	7,243,526		
	126,947,483	6,699,772	22,357,731	1,341,689		
	192,621,600	10,512,246	324,973,680	13,143,862		
	1,297,517,621	64,575,140	1,241,433,750	48,297,598	1,409,075,183	$53,841,518

ft steel bars—Prices (wholesale) at Pittsburgh, in cents per pound.

[From Iron Age, Jan. 6, 1921.]

fonth.	1899	1900	1901	1902	1903	1904	1905
	1.02	2.22	1.25	1.50	1.60	1.30	1.40
	1.12	2.21	1.30	1.51	1.60	1.30	1.40
	1.36	2.25	1.40	1.60	1.60	1.33	1.50
	1.56	2.10	1.47	1.60	1.60	1.35	1.50
	1.67	1.91	1.41	1.60	1.60	1.35	1.50
	1.98	1.52	1.40	1.60	1.60	1.35	1.46
	2.02	1.19	1.40	1.60	1.60	1.35	1.50
	2.14	1.05	1.44	1.60	1.60	1.35	1.50
	2.40	1.12	1.50	1.60	1.60	1.31	1.50
	2.39	1.09	1.53	1.60	1.60	1.30	1.50
	2.24	1.18	1.50	1.60	1.37	1.31	1.50
	2.20	1.25	1.50	1.60	1.30	1.34	1.50
	1.84	1.59	1.43	1.58	1.56	1.33	1.48
hly average	2.40	2.25	1.53	1.60	1.60	1.35	1.50
hly average	1.02	1.05	1.25	1.50	1.30	1.30	1.40

Soft steel bars—Prices (wholesale) at Pittsburgh, in cents per pound—Continu

[From Iron Age, Jan. 6, 1921.]

Month.	1906	1907	1908	1909	1910	1911
January	1.50	1.60	1.60	1.40	1.50	1.40
February	1.50	1.60	1.60	1.35	1.50	1.40
March	1.50	1.60	1.60	1.20	1.45	1.40
April	1.50	1.60	1.60	1.15	1.45	1.40
May	1.50	1.60	1.60	1.19	1.45	1.37
June	1.50	1.60	1.45	1.20	1.45	1.25
July	1.50	1.60	1.40	1.27	1.45	1.23
August	1.50	1.60	1.40	1.32	1.40	1.20
September	1.50	1.60	1.40	1.39	1.40	1.19
October	1.50	1.60	1.40	1.51	1.40	1.12
November	1.54	1.60	1.40	1.50	1.40	1.08
December	1.60	1.60	1.40	1.50	1.40	1.12
Average	1.51	1.60	1.49	1.33	1.44	1.26
Highest monthly average	1.60	1.60	1.60	1.51	1.50	1.40
Lowest monthly average	1.50	1.60	1.40	1.15	1.40	1.08

Month.	1913	1914	1915	1916	1917	1918	1919
January	1.70	1.20	1.10	2.03	3.15	2.90	2.70
February	1.70	1.20	1.10	2.31	3.25	2.90	2.70
March	1.85	1.20	1.15	2.65	3.63	2.90	2.61
April	1.84	1.15	1.20	2.88	3.75	2.90	2.35
May	1.70	1.14	1.20	3.00	4.00	2.90	2.35
June	1.60	1.11	1.21	2.75	4.25	2.90	2.35
July	1.50	1.12	1.25	2.63	4.50	2.90	2.35
August	1.40	1.19	1.39	2.56	4.30	2.90	2.35
September	1.40	1.20	1.34	2.60	4.00	2.90	2.35
October	1.39	1.15	1.44	2.75	2.90	2.90	2.39
November	1.29	1.10	1.62	2.83	2.90	2.90	2.69
December	1.21	1.07	1.84	3.00	2.90	2.80	2.75
Average	1.55	1.15	1.31	2.67	3.63	2.89	2.50
Highest monthly average	1.85	1.20	1.84	3.00	4.50	2.90	2.75
Lowest monthly average	1.21	1.07	1.10	2.03	2.90	2.80	2.35

Comparison of iron and steel bar prices—Yearly averages at Pittsburgh.[1]

[Per 100 pounds.]

	Soft steel bars.	Iron bars.		Soft steel bars.	Iron bars.		Soft steel bars.	Iron
1898	$0.95	$1.07	1906	$1.51	$1.93	1913	$1.55	
1899	1.84	1.95	1907	1.60	1.94	1914	1.15	
1900	1.59	2.15	1908	1.49	1.60	1915	1.31	
1901	1.42	1.80	1909	1.33	1.62	1916	2.67	
1902	1.58	1.94	1910	1.44	1.65	1917	3.64	
1903	1.56	1.77	1911	1.26	1.41	1918	2.89	
1904	1.33	1.48	1912	1.29	1.44	1919	2.49	
1905	1.48	1.87				1920	3.22	

[1] Compiled by American Iron and Steel Institute from weekly quotations in Iron Age.

STEEL BARS AND SMALL SHAPES.[11]

The official classification of the trade are:[12]

Rounds and squares $\frac{1}{4}$ to $\frac{3}{16}$ inch base up to 7$\frac{1}{2}$ inches.

Flats 1 to 6 inches by $\frac{1}{8}$ to 1 inch base up to 3$\frac{1}{2}$ to 6 inches b
to 4 inches.

[11] Does nor include shell steel.
[12] Maximum prices on iron and steel products, 1918. Amer. Iron and Steel Institute.

ons $\frac{1}{4}$ to 3 inches.
ounds 1 to 3 inches down to $\frac{3}{8}$ to $\frac{7}{16}$ inch.
vals, 1 to 4 inches by $\frac{1}{4}$ inch and thicker to $\frac{3}{8}$ to $\frac{7}{16}$ inch by
nd 15.
$\frac{3}{4}$ to $2\frac{1}{2}$ by $\frac{3}{8}$ inches and thicker $\frac{3}{8}$ to $\frac{7}{16}$ inch by $\frac{3}{32}$ inch.
ry decision 34694 does not agree with this; it establishes
ars "over $\frac{3}{16}$ by 7 inches and under."

PRICE APPROVED BY PRESIDENT WILSON SEPT. 24, 1917.

rice of steel bars and small shapes (under 3 inches) f. o. b.
gh, Pa., 2.90 cents.
t to the following list of extras (in cents per pound to be
the base price per pound) recommended by the committee
nd steel products of the American Iron and Steel Institute
er 1, 1917, May 21, 1918, and July 30, 1918:

l squares:
to $3\frac{1}{16}$ inches, base.

inch	$0.05
inch	.10
	.20
	.25
	.30
	.35
	.40
	.50
	.75
	1.00
	1.25
$\frac{1}{16}$ inches	.075
$\frac{3}{16}$ inches	.125
$\frac{5}{16}$ inches	.15
$\frac{7}{16}$ inches	.20
$\frac{9}{16}$ inches	.25
$\frac{11}{16}$ inches	.375
$\frac{13}{16}$ inches	.50
$\frac{15}{16}$ inches	.625

termediate sizes the next higher extra to be charged in all

nches by $\frac{1}{2}$ to 1 inch, base.	Cents extra.
nches by $\frac{1}{4}$ to $\frac{5}{16}$ inch	$0.10
inch by $\frac{1}{2}$ to $\frac{3}{4}$ inch	.20
inch by $\frac{1}{2}$ to $\frac{5}{16}$ inch	.25
inch by $\frac{1}{2}$ to $\frac{1}{2}$ inch	.25
inch by $\frac{1}{4}$ to $\frac{5}{16}$ inch	.35
by $\frac{3}{8}$ to $\frac{7}{16}$ inch	.50
by $\frac{1}{4}$ to $\frac{5}{16}$ inch	.60
by $\frac{1}{2}$ inch	.70
by $\frac{1}{4}$ to $\frac{5}{16}$ inch	.80
by $\frac{1}{8}$ to $\frac{5}{16}$ inch	1.00
inches by $1\frac{1}{16}$ to $1\frac{3}{16}$ inches	.05
inches by $1\frac{1}{4}$ to $1\frac{1}{4}$ inches	.10
inches by $1\frac{3}{8}$ to $2\frac{3}{4}$ inches	.15
inches by 3 to 4 inches	.20

mediate sizes, the next higher extra to be charged in all cases.

Steel bars—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883....	177	Steel * * * bars * * * ; all of the above classes of steel not otherwise specially provided for in this act:	
		Valued at 4 cents a pound or less	45 per cent ad valorem.
		Above 4 cents a pound and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2¾ cents per pound.
		Valued above 10 cents per pound	3½ cents per pound.
1890....	146	Steel * * * bars * * * all of the above:	
		Valued at 1 cent per pound or less	1/10 of 1 cent per pound.
		Valued above 1 cent and not above 1 3/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 3/10 cents and not above 1 5/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 5/10 cents and not above 2 3/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 2 3/10 cents, and not above 3 cents per pound	1 3/10 cents per pound.
		Valued above 3 cents and not above 4 cents per pound	1 7/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 4/10 cents per pound.
		Valued above 10 centsand not above 13 cents per pound	3½ cents per pound.
		Valued above 13 cents and not above 16 cents per pound	4 3/10 cents per pound.
		Valued above 16 cents per pound	7 cents per pound.
1894....	122	Steel * * * bars * * * all of the above:	
		Valued at 1 cent per pound or less	1/10 of 1 cent per pound.
		Valued above 1 cent and not above 1 3/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 3/10 cents and not above 1 5/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 5/10 cents and not above 2 3/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 2 3/10 cents and not above 3 cents per pound	1/10 of 1 cent per pound.
		Valued above 3 cents and not above 4 cents per pound	1 7/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	1 7/10 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	1 7/10 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	2 7/10 cents per pound.
		Valued above 13 cents and not above 16 cents per pound	2 7/10 cents per pound.
		Valued above 16 cents per pound	4 7/10 cents per pound.
1897....	135	Steel * * * bars * * *, all of the above:	
		Valued at 1 cent per pound or less	1/10 of 1 cent per pound.
		Valued above 1 cent and not above 1 3/10 per pound	1/10 of 1 cent per pound.
		Valued above 1 3/10 cents and not above 1 5/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 5/10 cents and not above 2 3/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 2 3/10 cents and not above 3 cents per pound	1/10 of 1 cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.	1 7/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	1 7/10 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	2 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	2 4/10 cents per pound.
		Valued above 13 cents and not above 16 cents per pound	2 7/10 cents per pound.
		Valued above 16 cents per pound	4 7/10 cents per pound.
1909....	131	Steel * * * bars * * *, all of the above:	
		Valued at three-fourths of 1 cent per pound or less	1/10 of 1 cent per pound.
		Valued above three-fourths of 1 cent and not above 1 1/10 cents per pound.	1/10 of 1 cent per pound.
		Valued above 1 1/10 cents and not above 1 5/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 1 5/10 cents and not above 2 1/10 cents per pound	1/10 of 1 cent per pound.
		Valued above 2 1/10 cents and not above 3 cents per pound	1/10 of 1 cent per pound.
		Valued above 3 cents and not above 4 cents per pound	1 7/10 cents per pound.
		Valued above 4 cents and not above 7 cents per pound	1 7/10 cents per pound.
		Valued above 7 cents and not above 10 cents per pound	1 7/10 cents per pound.
		Valued above 10 cents and not above 13 cents per pound	2 7/10 cents per pound.
		Valued above 13 cents and not above 16 cents per pound	2 7/10 cents per pound.
		Valued above 16 cents and not above 24 cents per pound	4 7/10 cents per pound.
		Valued above 24 cents and not above 32 cents per pound	6 cents per pound.
		Valued above 32 cents and not above 40 cents per pound	7 cents per pound.
		Valued above 40 cents per pound	20 per cent ad valorem.
1913....	110	Steel * * * bars * * *, if made by the Bessemer, Siemens-Martin, open-hearth, or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	8 per cent ad valorem.

COURT AND TREASURY DECISIONS.

Lines of demarcation between bars, bands, or strips, sheets and tes of steel have been established by the Treasury Department. D. 34694.)

The provision in paragraph 135 of the act of 1897 for steel bars ng without words of limitation was declared more specific than provision in paragraph 127 for "forgings of steel n. s. p. f." in s act, and forged steel bars were held dutiable under paragraph according to the value per pound and not under paragraph 127 forgings. (G. A. 6388, T. D. 27443.)

Hot-rolled steel bars were held properly classified at 8 per cent ad orem under paragraph 110 of the act of 1913 as against the porter's contention for free entry under paragraph 613 providing "steel ingots, cogged ingots, blooms, and slabs, die blocks or nks, and billets, if made by the Bessemer, Siemens-Martin, open-arth, or similar processes, not containing alloy, * * *." (Ab-act 41281.)

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ALLOY STEELS.

SUMMARY.

Alloy steels are special steels. The qualities of ordinary steels are due principally to their carbon content; the peculiar properties of alloy steels are attributable to the alloying metals or elements. Some of these properties are hardness, toughness, elasticity, and, in the case of high-speed tool steels (treated in another survey), the quality of retaining this temper when hot.

The alloy steels treated in this survey are in the forms of ingots, blooms, billets, and bars. The principal alloying metals or elements are nickel, chromium, molybdenum, vanadium, manganese (8 to 15 per cent), and tungsten. The highly important tungsten steels and other alloy metals used primarily in the manufacture of tools are treated in the survey on tool steels and are therefore not covered here. Manganese is present in all steels; but in ordinary carbon steel it constitutes only about 0.4 to 0.6 per cent of the weight.

The domestic production of alloy steel in 1918 amounted to 1,787,852 gross tons valued at about $500,000,000. In 1920 the country's output was 1,660,292 gross tons, of which 1,591,939 tons were ingots and 68,353 tons castings. Nearly 1,300,000 tons consisted of open-hearth steel. Over half of the remainder was electric steel.

Statistics regarding output in other countries are not available. Alloy steel, however, is produced in England, France, Germany, Sweden, Norway, and Canada. Some alloy steel is imported. An examination of the invoices at the New York Customs House indicates most of the imported alloy steel is tungsten tool steel. Exports of alloy steels are not separately listed, but they are evidently small.

The manufacture of alloy steels is a recent industrial development, and any precise statement of international relationship is impossible. With reference to organization and equipment the American producer of alloy steels is in a tolerably secure position. Some ferroalloys, however, which he uses are more expensive in the United States than in some European countries. This is particularly true of ferromanganese, ferrochrome, and ferrotungsten. Where the electric process is employed, hydroelectric power is more expensive than in Canada, France, Norway, and Sweden. The rates of wages are also higher. These handicaps in the case of many bulk lines thus far have been more or less offset by superior organization, equipment, and metallurgical experience and training.

Alloy steels vary greatly in chemical constituents and value, and hence ad valorem duties are more applicable than specific rates.

Alloy steels—Summary table.

year.	Domestic production.[1]	Imports for consumption.[2]	Ratio to production, imports.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual, or equivalent ad valorem rate.
	Long tons.	*Long tons.*	*Per cent.*				*Per cent.*
.....	567,819	.....	.....	.....	.....	.....	.....
.....	481,459	.....	.....	.....	.....	.....	.....
.....	792,501	.....	.....	.....	.....	.....	.....
.....	714,357	.....	.....	.....	.....	.....	.....
.....	646,953	[3] 6,992	1.081	$1,765,783.00	$264,845.25	$252.54	15.00
.....	1,021,147	5,874	.575	1,410,712.00	211,606.80	240.16	15.00
.....	1,362,615	5,308	.390	1,670,296.00	250,544.40	314.68	15.00
.....	1,644,335	4,344	.264	1,497,228.00	224,584.20	344.67	15.00
.....	1,787,852	3,165	.177	1,357,221.00	203,583.15	428.82	15.00
.....	1,481,188	3,127	.211	2,271,155.00	340,673.25	726.30	15.00
.....	1,787,852	2,759	.154	1,545,243.00	231,786.45	560.07	15.00
.....	1,481,188	2,973	.201	2,870,033.00	430,504.95	965.37	15.00
.....	1,660,292	4,586	.277	2,943,156.00	441,473.40	641.77	15.00

r years.
steel ingots, cogged ingots, blooms and slabs; die blocks or blanks, billets, and bars, etc., hout alloys, made by the crucible, electric, or cementation process and steel by whatever r le, n. s. p. f., containing alloys.
ct. 4, 1913, to June 30, 1914.

General Information.

graph 110 * * * all steels by whatever process made, ng alloys, such as nickel, cobalt, vanadium, chromium, tung- olfram, molybdenum, titanium, iridium, uranium, tantalum, nd similar alloys, 15 per cent ad valorem.

DESCRIPTION AND USES.

steels are special steels containing elements or metals which to them certain peculiar properties. Among these properties lness and elasticity, and in the case of tungsten steel, treated parate survey, the quality of maintaining its temper at red n the case of ordinary steels the distinguishing qualities are imparted principally by their carbon content. Nickel, chro- nolybdenum, vanadium, and manganese (manganese 8 to 15) are the alloys most used in the steels treated in this survey. loying elements are aluminum, boron, cerium, iridium, plati- ntalum, titanium, uranium, and zirconium, but the steels ith these elements are not manufactured in commercial quan- The highly important tungsten steels are described in a sepa- vey. All steels contain small amounts of manganese, silicon, rus, and sulphur, which are injurious if excessive in amount. ese is a constituent of all steels, but in ordinary carbon steels tes about four-tenths to six-tenths of 1 per cent. Manganese s of 1 per cent and less than 7 per cent renders the steel hard tle.

lloy steels included in this survey are in the forms of ingots, billets, bars, and castings. Alloy steels in the forms of forg- les, structural shapes, shafting, and other finished forms are in other surveys.

steels.—Nickel adds toughness to steel. It is the pioneer steel alloys, and heat treatment has greatly enhanced its o that nickel steel holds a premier position in alloy steel

metallurgy. When heat treated, it has remarkably good mechanical qualities, but has a tendency to laminations and seams. It has excellent casehardening and machining qualities and possesses strength and ductility and resists corrosion. Nickel is used with chromium and tungsten for bearings. It is also used for crank shafts, gears, axles, valves, bolts, nuts, connecting rods, and is of considerable importance for aircraft purposes. It is also employed with chromium for armor plate and cannon. Military steels are practically all nickel steels. During the war the requirements of the Allies were about 4,000,000 pounds of nickel per month. The United States required, in 1918, 6,528 short tons of nickel for guns, shells, armor plate, small arms, helmets, and the like.

Nickel steels can be made by any steel-making process. The nickel content in such steels ranges from 1 to 5 per cent. In the manufacture of nickel steel there is no loss by the oxidation of nickel. Such steel can be forged and rolled like simple carbon steel. In 1913 150,000 tons of nickel steel were made in the United States, mostly in the open-hearth furnace. The rails made with 3.5 per cent of nickel resist rust and breakage and last three times as long as ordinary carbon steel rails. They cost, however, about twice as much.

Chrome nickel steel.—Chrome nickel steel is a common alloy steel for general structural purposes. Chromium and nickel together have the beneficial effects of both nickel and chromium without the disadvantages of either separately. Nickel modifies the brittleness which chromium is likely to impart to the steel and chromium adds hardness. The best ratio for structural purposes is 2½ parts of nickel to 1 part chromium. The proportion commonly used is 1.5 per cent nickel to 0.5 per cent chromium. Chrome nickel steel forges and machines well, and when heat treated it has a strength of 325,000 pounds per square inch as compared with 60,000 pounds per square inch for simple carbon steels.

Chrome steel.—Chromium is one of the most important alloys used in steel. Its peculiar quality is to add hardness and strength. It modifies the brittleness of high carbon steel and is resistant to rust and abrasion. In 1913 204,000 tons of domestic steel contained chromium. Of this amount 90,000 tons were made in open-hearth furnaces. Chrome steel is used in ball bearings, armor plate, guns, gun linings, locomotive frames and springs, safes, tools, and in other steels requiring a very hard surface. Among other uses of chrome steel are stamped shoes, dies, and safe plates. Chrome steels are generally used in combination with other elements like nickel, vanadium, tungsten, and molybdenum.

Chrome-vanadium steel.—This steel is used for automobiles, aircraft, armor plate, and structural parts of machines. This steel machines rapidly.

Molybdenum steel.—Molybdenum steel is of peculiar interest, since molybdenum is the only ore of the alloying metals treated in this survey that can be obtained in ample quantities and at low cost from domestic deposits. Extensive claims have been made as to the value of molybdenum as an alloying element, but in the United States molybdenum steels have not made very great commercial progress. At one time molybdenum was considered a substitute for tungsten in the manufacture of high-speed tool steels, but this use is now discarded and molybdenum is now employed principally as a substitute

in certain cases for vanadium. It is used in certain structural and automotive steels. The percentage of molybdenum in such steel is usually small, ranging from 0.35 to 0.5 per cent. It is claimed that molybdenum steel is of superior value for springs and has been used in Liberty motor crank shafts and to some extent in other automobile parts. Molybdenum steels have been employed in England and on the Continent to a greater extent than in the United States, but even in Europe the utilization of such steel is limited.

Vanadium steel.—Vanadium is a very effective deoxidizer and acts as a scavenger in melting the steel. In the manufacture of vanadium the melting losses are from 10 to 20 per cent. Vanadium ores come chiefly from Peru, but there are quantities of it in Colorado. Vanadium to the extent of 0.2 to 0.4 per cent gives steel a dense, fine structure and adds great strength and toughness to steel. Vanadium steel is used for automobile parts, gears, and the like.

Vanadium-chrome steel.—This steel represents an important development in the manufacture of structural material, particularly for automobiles, as it is free from surface defects. It has been said that the strength of an automobile depends upon vanadium. In 1913 90,000 tons of vanadium steel were made in open-hearth furnaces. The chromium content in this steel intensifies the influence of the vanadium as it does that of nickel in chrome-nickel steel, but to even a greater extent.

Vanadium nickel steel.—This steel contains 0.25 of vanadium and 3.5 per cent of nickel.

Manganese steel.—Simple carbon steels contain manganese up to about 1 per cent, generally, from 0.4 to 0.6 per cent. These steels, however, are not classed as manganese steels. After a content of 1 per cent is used new qualities appear in the steel. With an increase of manganese to 6 or 7 per cent, the hardness and brittleness of the steel increases so rapidly that the material is not of commercial value. As the manganese content rises above 6 or 7 per cent the steel becomes tough again, reaching its maximum strength with a manganese content of 12 or 13 per cent. Above 16 or 17 per cent the steel becomes brittle again. Manganese steel is greatly resistant to abrasive wear, and possesses great strength and ductility against heavy impact of hard substances. The most commonly used manganese steels contain from 11 to 15 per cent manganese and are employed in the manufacture of mining machinery, tractor treads, steel rails on curves, railroad crossings, and safes. Such steel can not be softened. On account of its great hardness it must be cast to shape and ground. When the metal is first cast, it is brittle, but when it is quenched in water it is tough, ductile, and hard. One disadvantage in the use of this steel is its quality of yielding or "flowing" under pressure.

Miscellaneous alloy steels.—Mention may be made in this connection of certain other alloy steels which are not used in commercial quantities. Cobalt steel is characterized by strength and elasticity, but is not used to any great extent at the present time because other alloys are cheaper. Copper steel is of little commercial importance. The beneficial effect of copper, however, seems to have been demonstrated by the United States Navy when the copper content is not greater than 2 per cent. Nickel steels with 0.4 to 0.7 per cent of copper are said to show a certain superiority. A small amount of roofing, containing 0.24 *per cent* copper, is manufactured.

Silicon steel is being employed in increasing quantities in the production of electric apparatus. During the war also silicon steel was used in the manufacture of shrapnel bars. Silico-manganese steel with 1.2 to 2 per cent silicon and 0.7 to 1 per cent manganese is a tough steel used in the manufacture of springs.

Tungsten steels, which constitute a very important division of alloy steels are treated in the survey on Tool Steels.

DOMESTIC PRODUCTION.

Alloy steels have been of rapidly increasing importance in recent years. The production of alloy steels in the United States in the form of ingots and castings for the year 1909 amounted to 181,980 gross tons. In 1919 it amounted to 1,481,188 gross tons and in 1920 to 1,660,292 tons. To-day many important industries depend in large measure upon alloy steels.

Raw materials.—The most important raw materials in the manufacture of alloy steels are metallic steel and the alloying metals, either in their metallic forms or in the form of ferroalloys. Manganese, chromium, molybdenum, and vanadium are usually added to the steel by means of ferroalloys. Nickel is usually added in its metallic form. The ferroalloys are partly of domestic manufacture and partly imported. Where the ferro alloys are of domestic manufacture, the ores are for the most part imported. Before the outbreak of the World War about half of the ferromanganese used in the United States was imported and a considerable amount of the ferrochrome. Ferrovanadium has for many years been a domestic product, although the vanadium ores are for the most part imported. The unalloyed iron and steel used in the manufacture of alloy steels is of domestic production.

Equipment.—The equipment used in the manufacture of alloy steels consists of the open-hearth, crucible, Bessemer, or electric furnaces. Practically all the alloy steels made in the United States are produced in these furnaces. The most important is the open-hearth, but the electric process is of growing importance.

Methods of production.—The survey on Steel Ingots, Castings, etc., describes the principal steel-making processes, and only brief references to these processes will be made here. The methods are designated by the furnaces employed—the open-hearth, Bessemer, crucible, and electric. Some of these processes are used in connection with others, as, for example, the open-hearth process is often employed in connection with the electric process. Where the open-hearth and Bessemer are both employed, or where the electric process is used with one or the other, we have what is called the "duplex" process, and, where all three are employed, the "triplex" process. The duplex and triplex methods are used to a considerable extent in the manufacture of alloy steels. The Bessemer process in alloy-steel production is used only in the making of manganese steel, the oxidation of the process being limited by the manganese which is added later and the high temperature of the process being desirable, as manganese steel is cast in the form needed. The crucible process is employed only when the purest iron or steel is used. The temperature in this process is high, rising to about 3,000° F. Purity, the

ence of oxidation, and sulphur absorption are the causes of the eriority of crucible steel. The crucible process, however, labors er this disadvantage. A comparatively small unit is produced in iven period, and the labor involved requires a high degree of skill. e electric process is increasing in importance and bids fair to suc- d the crucible method of steel manufacture. In this process ap up to 100 per cent can be used, and wherever electric power d scrap are available this process can be employed and often very nomically. In 1919, however, out of 1,481,000 tons of alloy steel duced in the United States, nearly 1,200,000 tons were produced the open-hearth process.

Alloy steels require heat treatments similar to those used in the nufacture of simple carbon steel. Surface defects must be re- ved. In addition to these treatments alloy steels require much spection, chipping, grinding, forging, straightening, cutting, and ugh machining, which add materially to their cost. These treat- ents require a considerable number of men, even in a small plant. the treatments to which alloy steels are subjected, heat treatment perhaps the most distinguishing feature. This treatment can adily change the grade and structure of the steel. It has become special brand of metallurgical engineering, requiring great skill.

Organization and geographical distribution.—Both large and small ants are efficiently organized in the United States. The greatest eel companies making alloy steels are often in a position to employ e most-needed technicians in the manufacture of their product. can not be stated, however, that alloy-steel manufacture, as de- loped in the United States, has shown any marked tendency in the rection of large producing units.

The industry is largely concentrated in the steel-producing region the country, extending from Pennsylvania west to Illinois and isconsin. In 1914, according to the report of the Census Bureau, ere were 57 manufacturers of alloy steels, of which 32 were in nnsylvania, 7 in New York, 5 in Ohio, 3 in New Jersey, 4 in Wis- nsin, 2 in Illinois, and 1 each in four other States.

Domestic production and consumption.—The domestic output of loy steels has increased very greatly during the past 10 or 15 years. 1 1909 the country's output, according to the American Iron and teel Institute, amounted to 181,980 gross tons. According to the ederal census for the same year, the output was 158,216 gross tons. 1 1919 the country's output was 1,481,188 gross tons, the maximum roduction having been reached in 1918, when 1,787,852 tons were anufactured. The consumption of alloy steels is difficult to esti- ate on account of the absence of statistics of exports and imports. xports, however, are insignificant, while the imports, though not rge, are appreciable. The statement can be made that consump- on exceeds production. Most of the imported alloy steels consist of ngsten steel, which is treated in the survey on Tool Steels.

History of the industry.—The manufacture of alloy steels is of com- aratively recent development. The introduction of automobiles bout 1900, requiring steel of exceptional strength, has been an im- ortant factor in the growth of this industry. Other influences were so at work, among which the manufacture of electric appliances d supplies may be mentioned. The use of tool steels, particularly gh-speed steel, was also an important factor in the growth of this

industry. During the World War alloy steels were employed in the production of armor plate, shrapnel bars, etc.

FOREIGN PRODUCTION.

Figures concerning foreign production are not available. It is known, however, that England, France, Norway, Sweden, Germany, and Canada all produce alloy steels.

IMPORTS.

The statistics of imports are unsatisfactory, as alloy steels are grouped with other classes of steel prior to 1916 and under several designations since that time. The most important of the foreign alloy steels entering this country is tungsten steel. In the calendar year 1919 there was imported under the head of "Steel by whatever process made n. s. p. f. containing alloys such as nickel, cobalt, vanadium chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron and similar alloys," 204,457 pounds, valued at $122,964. This importation, however, is only a fraction of the total importation of alloy steels.

PRICES.

The price of alloy steel is quoted by the pound and varies greatly according to the kind and amount of alloy used. In April, 1920, the following prices on alloy steels were quoted:

	Cents per pound.
3.5 per cent nickel steel	9.4
Chrome-nickel steel	11.2
Chrome steel	16
Chrome-vanadium steel	10.75
Vanadium steel	12-20
Manganese steel (12 per cent manganese)	15

The prices of alloy steels like those of other products showed a marked tendency to rise during the progress of the war. After the signing of the armistice, prices fell, and then rose again in the spring and summer of 1920. During the fall of 1920 prices declined. Foreign prices exhibited the same general trend as American prices, but quotations are very fragmentary.

TARIFF HISTORY.

The tariff act of 1913 contained the first mention of alloy steels and imposed a duty of 15 per cent ad valorem without reference to the stage of advancement or character of the alloying metal. Previous acts provided specific duties on steels based upon a sliding scale of value per pound. Thus the act of 1894 placed a duty on steel in all forms and shapes not specially provided for in the act of 0.3 cents per pound when the steel was valued at 1 cent per pound or less, and 4.7 cents per pound when valued above 16 cents per pound. Intermediate rates were imposed when the steel was valued at more than 1 cent per pound and not more than 16 cents per pound. Similar rates on a sliding-scale basis were prescribed in the acts of 1897 and 1909.

COMPETITIVE CONDITIONS.

The manufacture of alloy steels is now fairly well established in the United States. In the matter of technical skill the domestic manufacturer is at least equal to his foreign competitor and his equipment is even superior. Domestic manufacturers have the ability to coordinate the thermal, chemical, electrical, and mechanical organizations so as to produce on a large scale. The raw materials, however, for some of the alloy steels are somewhat cheaper in some countries of Europe than in the United States. This is particularly true of ferromanganese, ferrochrome, and ferrotungsten. When the electric process is used, the cost of water power is less in some foreign countries than in the United States. Notwithstanding our great natural resources, in the production of hydroelectric power some European countries, like Norway, Sweden, and France, and Canada in North America, have certain advantages over this country in the possession of a combination of high heads and a comparatively steady flow of water. Where hydroelectric power is an appreciable item in the total cost, these countries have certain advantages over the United States. The rates of wages in European countries are also considerably less than in the United States. In many industries the high wage rates in the United States are more than offset by the greater production per man employed, but this is offset is less certain in the manufacture of alloy steels, particularly where the crucible and electric processes are employed.

TARIFF CONSIDERATIONS.

With reference to competitive conditions American producers have the advantage of superior organization and excellent equipment. They are to some extent, however, handicapped by the payment of higher prices for some of the ferro-alloys and alloying metals, greater charges for hydroelectric power where the electric furnace process is used, and higher wage rates. Up to the present time, however, these handicaps have not been very serious, except possibly in the case of tungsten steels. In the matter of classification, alloy steels vary so in value that specific rates do not apply so well as ad valorem. Furthermore, the conditions of production differ to a considerable extent with the alloys used. While this country, for example, imports a considerable amount of ferrochrome, she produces her own ferrovanadium. Vanadium steels are thus more cheaply produced in this country than abroad. Chrome steels, on the other hand, are more likely to meet some foreign competition in the domestic market.

In view of the growing importance of alloy steels, it might be well to provide for them in a paragraph or paragraphs by themselves, rather than in a paragraph with a number of other products. Treated by themselves the rates could be better apportioned among the different steels according to the nature and requirements of the industry.

In view of the high value of alloy steels care should be exercised so that they would not be imported at rates lower than those intended by Congress. Paragraph 518 places scrap steel on the free list, and steel which could be readily used as a ferroalloy might be admitted free of duty, when most of the ferroalloys themselves are dutiable at 15 per cent ad valorem under the present (1913) tariff.

PRODUCTION IN UNITED STATES—STATES.

Alloy steel ingots and castings.

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Tons.	*Tons.*		*Tons.*	*Tons.*
New Jersey		9,000	Pennsylvania	226,426	93,529
New York	9,729	43,390	All other	36,719	7,023
Ohio	33,082	5,292	Total	[1] 305,956	158,216

[1] Annual statistics Am. I. and S. Inst. give the production in the United States in 1914 as 577,107 tons.

Alloy steel: Ingots (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
Illinois	[2]	[2]	Massachusetts		[2]
Indiana	[2]		New York		43,228
New Jersey	10,851	4,100	All other	58,715	6,830
Ohio	[2]	5,292			
Pennsylvania	224,562	91,930	Total	294,128	151,300

[2] Included in "All other."

Alloy steel: Castings (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
Delaware	[2]	[2]	Wisconsin	290	[2]
Illinois	[2]		Connecticut		[2]
New Jersey	[2]	4,900	Michigan		[2]
New York	[2]	8	All other	7,199	419
Ohio	[2]				
Pennsylvania	4,339	1,589	Total	11,828	6,916

[2] Included in "All other."

Alloy steel.

[Figures from Federal census.]

By kind of alloy.	1914	1909	By kind of alloy.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
Nickel-chrome	102,562	26,929	Chrome-tungsten-vanadium	2,334	[3]
Nickel	69,955	37,607	Silicon-manganese	2,240	[3]
Chrome	23,258	11,269	Chrome-tungsten	1,546	600
Nickel-chrome-vanadium	14,123	9,280	Chrome-nickel-titanium	1,106	[3]
Chrome-vanadium	9,280	4,406	Miscellaneous	233	17,912
Titanium	8,477	40,477	Unclassified	61,314	
Tungsten	4,204	1,697			
Copper	2,759		Total	305,956	158,216
Vanadium	2,565	8,039			

[3] Figures not available.

Alloy steel: Open-hearth (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
	(1)		Pennsylvania	210,827	86,386
	(1)		Massachusetts		(1)
sey	(1)	2,014	All other	20,191	6,643
rk	(1)	(1)			
	33,082	5,292	Total	264,100	100,335

ded in "All other."

Alloy steel: Open-hearth, basic (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
	(1)		Pennsylvania	158,541	(1)
a	(1)		Massachusetts		(1)
rsey	(1)	(1)	All other	71,867	80,950
ork	(1)	(1)			
	(1)	5,292	Total	230,408	86,242

luded in "All other."

Alloy steel: Open-hearth, acid (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
are	(1)		Pennsylvania	(1)	(1)
	(1)		All other	33,692	14,093
rsey	(1)	(1)			
ork	(1)		Total	33,692	14,093
	(1)				

luded in "All other."

Alloy steel: Bessemer (not reported prior to 1909).

[Figures from Federal Census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons*
	(1)		Connecticut		(1)
ersey	(1)	(1)	Delaware		(1)
ork	(1)	(1)	All other	8,996	45,324
	(1)				
ylvania	(1)	(1)	Total	9,146	45,324
sin	150	(1)			

luded in "All other."

Alloy steel: Crucible, electric, and miscellaneous (not reported prior to 1909).

[Figures from Federal census.]

States.	1914	1909	States.	1914	1909
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
Illinois	(a)	(a)	Michigan		(a)
New Jersey	(a)	(a)	All other	7,382	2,449
New York	9,729	3,038			
Pennsylvania	15,599	7,067	Total	32,710	12,554
Wisconsin	(a)				

[a] Included in "All other."

Alloy-steel ingots and castings.

[Figures from annual statistical report of the American Iron and Steel Institute.]

Years.	Ingots.	Castings.	Total.	Years.	Ingots.	Castings.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*		*Gross tons.*	*Gross tons.*	*Gross tons.*
1909	158,978	23,002	181,980	1915	923,251	97,896	1,021,147
1910	538,402	29,357	567,819	1916	1,306,157	56,458	1,362,615
1911	425,169	56,290	481,459	1917	1,576,806	67,529	1,644,335
1912	689,392	103,109	792,501	1918	1,721,367	66,485	1,787,852
1913	625,430	88,927	714,357	1919	1,435,816	45,372	1,481,188
1914	577,107	69,846	646,953				

Alloy-steel ingots and castings, by processes (1918).

[Figures from annual statistical report of the American Iron and Steel Institute, 1918.]

Processes.	Ingots.	Castings.	Total.	Processes.	Ingots.	Castings.	Total.
	Tons.	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*
Open-hearth steel, basic	1,013,913	10,724	1,024,637	Electric steel	287,885	3,076	290,961
Open-hearth steel, acid	323,913	29,191	353,104				
Bessemer steel	41,286	23,430	64,716	Total	1,721,367	66,485	1,787,852
Crucible steel	54,370	64	54,434				

PRODUCTION OF ALLOY STEELS.[a]

	1909	1914	1913 [b]		1909	1914	1913
					Tons.	*Tons.*	*Tons.*
Establishments	36	57	.....	Crucible and electric	12,557	32,710	[c] 28,279
	Tons.	*Tons.*	*Tons.*	Total ingots	151,300	294,128	.....
Basic open-hearth	86,242	230,408	.....	Castings	6,916	11,828	.....
Acid open-hearth	14,093	33,692	.....				
Bessemer	45,334	9,146	.....	Total	316,442	611,912	28,279

[a] Census of manufacture, 1914. [b] Mineral Industry. [c] Crucible.

Alloy steel ingots and castings, by processes (1919).

[Figures from annual statistical report of the American Iron and Steel Institute, 1919.]

Processes.	Ingots.	Castings.	Total.	Processes.	Ingots.	Castings.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*		*Gross tons.*	*Gross tons.*	*Gross tons.*
Open-hearth steel, basic	1,056,137	2,850	1,058,987	Electric and miscellaneous steel	175,575	6,057	181,632
Open-hearth steel, acid	114,923	22,903	137,826				
Bessemer steel	66,581	13,503	80,084				
Crucible steel	22,600	59	22,659	Total	1,435,816	45,372	1,481,188

Alloy-treated steel rails.

[Figures from annual statistical report of the American Iron and Steel Institute.]

rs.	Titanium.	Other alloys.	Total.	Years.	Titanium.	Other alloys.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*		*Gross tons.*	*Gross tons.*	*Gross tons.*
.....	256,759	565	257,324	1915.....	21,191	3,779	24,970
.....	152,990	999	153,989	1916.....	26,493	2,069	28,562
.....	141,773	7,494	149,267	1917.....	15,273	1,262	16,535
.....	47,655	11,864	59,519	1918.....	2,891	220	3,111
.....	23,321	4,616	27,937	1919.....	6,207	269	6,476

Imports by Countries.

ingots, blooms, slabs, billets, etc., with or without alloys, made by the crucible, electric, or cementation process.

[Calendar years.]

Imported from—	1918[1]		1919		1920	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
.....	3,298	$2,394	.....	.....	.....	.....
y.....	.....	.....	45,931	$28,057	.....	.....
.....	1,464,106	293,522	1,809,446	1,181,956	.....	.....
Kingdom.....	2,582,513	795,073	4,252,243	1,552,802	.....	.....
.....	108,129	19,514	92,812	33,110	.....	.....
Total.....	4,158,046	1,110,503	6,200,432	2,795,925	10,168,501	$2,937,388

1 to Dec. 31, 1918.

Imports for Consumption—Revenue.

ingots, cogged ingots, blooms and slabs; die blocks or blanks; billets and bars and ered or beveled bars; pressed, sheared, or stamped shapes, not advanced in value or dition by any process or operation subsequent to the process of stamping; hammer lds or swaged steel; gun-barrel molds not in bars; alloys used as substitutes for steel the manufacture of tools; all descriptions and shapes of dry sand loam or iron- lded steel castings; and steel, n. s. p. f., if made by the crucible, electric, or cementa- process, either with or without alloys, and finished by rolling, hammering, or rwise.

	Rates of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
..	15 per cent.....	15,651,380½	$1,765,635.00	$264,845.25	$0.113	15.00
..	Free, C. R., article 392.....	11,322	148.00	.....	.013	.....
..	15 per cent.....	13,157,192	1,410,712.00	211,606.80	.107	15.00
..	.....do.....	11,604,969	1,624,248.00	243,637.20	.140	15.00
..	.....do.....	9,286,740	1,426,423.00	213,963.45	.154	15.00
..	.....do.....	6,048,579	1,271,946.00	190,791.90	.210	15.00
..	.....do.....	1,817,633	803,815.00	120,572.25	.442	15.00
..	.....do.....	6,028,383	1,489,695.00	223,454.25	.247	15.00
..	.....do.....	3,318,726	1,566,025.00	234,903.75	.472	15.00
..	.....do.....	3,208,563	837,889.00	125,683.35	.261	15.00

4, 1916, to June 30, 1914, under act of 1913.
use of the United States.
s not include "Billets and bars and tapered or beveled bars."
endar years.

Steel, by whatever process made, n. s. p. r., containing alloys, such as nickel, cobalt, vanadium, chromium tungsten, or wolfram, moylbdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.[5]

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1916	15 per cent	283,659	$46,048.00	$6,907.20	$0.162	15.00
1917	do	443,265	70,805.00	10,620.75	.160	15.00
1918	do	1,041,108	85,275.00	12,791.25	.082	15.00
1919	do	224,581	124,323.00	18,648.45	.554	15.00
1918 [4]	do	151,424	55,548.00	8,332.20	.367	15.00
1919 [4]	do	204,457	122,964.00	18,444.60	.601	15.00
1920 [4]	do	883,740	371,147.00	55,672.05	.420	15.00

[4] Calendar years.
[5] Not listed prior to 1916.

Steel billets (except Bessemer, etc.,) and bars and tapered or beveled bars (merchant bars) if made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.[6]

Fiscal year.[6]	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1919	15 per cent	4,961,968	$1,343,017.00	$201,452.55	$0.271	15.00
1919 [4]	do	3,137,031	1,181,044.00	177,156.60	.376	15.00
1920 [4]	do	6,179,410	1,734,120.00	260,118.00	.281	15.00

[4] Calendar years
[6] Included in steel ingots, cogged ingots, etc., prior to 1919.

PRICES.

Alloy steels, in cents per pound at mills.[1]

[Quotations by manufacturers to the United States Tariff Commission, April, 1920.]

Kinds of steel.	Cents per pound.
Chrome steel	14 –17.5
Chrome-vanadium steel	10.75–24
Nickel steel	7.5 –10
Nickel-chrome steel	[2] 7.5 –12
Vanadium steel	12 –35
Manganese	15

[1] There are so many specifications that it is difficult to quote prices. Steels vary so much in chemical content that even for the same kind of steel the price varies greatly in accordance with even small variations in chemical contents and chemical combinations. The prices quoted, however, will give a fair idea of the range in value of commonly-used alloy steels.
[2] Special grade, 19 cents.

RATES OF DUTY.

Alloy steels.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
	122	* * * and steel in all forms and shapes not specially provided for in this Act, all of the above valued at one cent per pound or less.	$\frac{1}{10}$ cent per pound.
		Valued above one cent and not above one and four-tenths cents per pound.	$\frac{2}{10}$ cent per pound.
		Valued above one and four-tenths cents and not above one and eight-tenths cents per pound.	$\frac{3}{10}$ cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{4}{10}$ cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{5}{10}$ cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$1\frac{5}{10}$ cents per pound.
		Valued above four cents and not above seven cents per pound.	$1\frac{6}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	$1\frac{8}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above thirteen cents and not above sixteen cents per pound.	$2\frac{4}{10}$ cents per pound.
		Valued above sixteen cents per pound	$4\frac{7}{10}$ cents per pound.
	135	* * * and steel in all forms and shapes not specially provided for in this Act, all of the above valued at one cent per pound or less.	$\frac{1}{10}$ cent per pound.
		Valued above one cent and not above one and four-tenths cents per pound.	$\frac{2}{10}$ cent per pound.
		Valued above one and four-tenths cents and not above one and eight-tenths cents per pound.	$\frac{3}{10}$ cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{4}{10}$ cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{5}{10}$ cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$1\frac{5}{10}$ cents per pound.
		Valued above four cents and not above seven cents per pound.	$1\frac{6}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	2 cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	$2\frac{5}{10}$ cents per pound.
		Valued above thirteen cents and not above sixteen cents per pound.	$2\frac{8}{10}$ cents per pound.
		Valued above sixteen cents per pound	$4\frac{7}{10}$ cents per pound.
	131	* * * and steel not specially provided for in this section, all of the above valued at three-fourths of one cent per pound or less.	$\frac{3}{10}$ cents per pound.
		Valued three-fourths of one cent and not above one and three-tenths cents per pound.	$\frac{4}{10}$ cent per pound.
		Valued above one and three-tenths cents and not above one and eight-tenths cents per pound.	$\frac{5}{10}$ cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{6}{10}$ cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{7}{10}$ cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$1\frac{7}{10}$ cents per pound.
		Valued above four cents and not above seven cents per pound.	$1\frac{8}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	$1\frac{9}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above thirteen cents and not above sixteen cents per pound.	$2\frac{3}{10}$ cents per pound.
		Valued above sixteen cents and not above twenty-four cents per pound.	$4\frac{7}{10}$ cents per pound.
		Valued above twenty-four cents and not above thirty-two cents per pound.	6 cents per pound.
		Valued above thirty-two cents and not above forty cents per pound.	7 cents per pound.
		Valued above forty cents per pound	20 per cent ad valorem.
	110	* * * and all steels by whatever process made, containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	15 per cent ad valorem.

TOOL STEELS.

Summary.

Tool steels, as indicated by the name, are steels used largely in manufacture of tools. There are two classes of such steels—p carbon and alloy steels. The latter may be further divided tungsten and other alloy tool steels. Tungsten added to steel re in increased hardness, particularly at high temperatures. What called "high-speed steels" generally contain from 12 to 18 per tungsten with small percentages of chromium, vanadium, and m ganese. Such steels are used in tools for cutting metals and h the property of maintaining their cutting edges under a red h when ordinary cutting tools would be rendered useless.

There are no published statistics of the production of tool ste the United States. Reports made to the Tariff Commission various manufacturers seem to show that during the war pe the country's output more than doubled, the more costly tool st having a greater increase than the cheaper grades.

Tool steels are more expensive than ordinary steels, having b made with particular care and received special heat treatm They are made in small batches and usually by one of the m expensive processes, such as crucible or electric. The direct la cost in the preparation of this steel forms a much larger percen of the total cost than in the case of ordinary low-carbon st Wages are materially higher in the United States than in compe European countries, and these higher wages can not so readil offset by larger production per man employed as in the case of m production of low-carbon steel by the Bessemer and open-he processes; the foreign producer of tool steels therefore has rela advantages in the matter of lower labor cost. In the case of tung steels foreign manufacturers are also in a position of some advan in the procurement of tungsten metal or ferrotungsten at lo prices than those prevailing in the United States.

In proportion to domestic consumption, the importation of steel is many times as large as that of low-carbon steel. Before war a still larger proportion of this steel was imported. The princ contributing countries have been England, Sweden, Germ France, and Austria.

General Information.

TOOL STEELS.

Act of 1913, Paragraph 110.

* * * steel ingots, cogged ingots, blooms and slabs, die blocks or blanks; bi and bars and tapered or beveled bars; pressed, sheared, or stamped shapes not adva in value or condition by any process or operation subsequent to the process of stamp hammer molds or swaged steel; gun-barrel molds not in bars; * * * all des tions and shapes of dry sand, loam, or iron molded castings, sheets, and plates; ro wire rods in coils or bars not smaller than twenty one-hundredths of one inch in di

er, and steel not specially provided for in this section, all the foregoing when made
the crucible, electric, or cementation process, either with or without alloys, and
nished by rolling, hammering, or otherwise, and all steels by whatever process made,
ntaining alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram,
olybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, 15
er centum ad valorem.

DESCRIPTION.

There are two main classes of tool steels—plain carbon and alloy steels. For tariff purposes the latter class should be further divided into tungsten steels and other alloy tool steels.[1]

Tool steels, as the name implies, are steels used largely for the manufacture of tools, and are distinguished from other classes of steel in being generally (1) more expensive, (2) of uniform quality for each grade), (3) subject to heat treatment to improve the grain and structure, and (4) made with special care and in relatively small batches by one of the more expensive processes. Tool steels whether containing alloys or not should be carefully distinguished from many classes of structural alloy steels, as, for example, many nichrome steels and even armor plate. The main use of tool steels of all classes is for cutting tools for working metal. Of these perhaps the most important at the present time are high-speed steels, generally containing relatively large percentages of tungsten. This is the most costly class of steel.

Medium-priced steels are used for metal working, woodworking, and the manufacture of various parts of machines, particularly in the automotive industry and in mining machinery, which are subject to vibration and shock. Relatively low-priced tool steels are used in mining drills (for cutting rock) and in certain classes of farm implements.

Tungsten steels.—The addition of tungsten to steel results in increasing the hardness and particularly the hardness of elevated temperatures. The most important tungsten steels are so-called high-speed steels used in tools for cutting metals and having the property of maintaining their cutting edges under a red heat which would render ordinary cutting tools useless. Tungsten is also used in smaller percentages in the manufacture of tools that are not required to withstand a red heat, but which may occasionally be subjected to temperatures that would injure the temper of a plain carbon steel. Fast-finishing tools, containing say 3 to 5 per cent of tungsten, are in this class. Tungsten steel is also employed to some extent in valves for internal-combustion engines, since it is harder and better able to withstand the heat from exhaust gases than most other kinds of steel. Steel containing tungsten is also used in connection with internal-combustion engines in magnetos, where it forms magnets which hold their magnetism longer and have a greater saturation value than those made from almost any other material.

High-speed steel ordinarily contains tungsten, chromium, manganese, vanadium, and other alloying elements, combined with carbon and iron. The amount of tungsten varies according to the manufacture and the precise character of the work for which the

[1] It is possible that tungsten steels might be further divided into steels containing 12 per cent or more of tungsten and tungsten steel containing under 12 per cent of this metal. Tungsten-bearing ores, tungsten metal, and ferrotungsten—the most important raw materials entering into the manufacture of tungsten steel—are discussed in separate surveys prepared by the Tariff Commission.

steel is to be employed, but the chief grades used in the United States contain either about 14 per cent or about 18 per cent of this costly metal. The latter is the more expensive and in most cases is the best grade of high-speed steel. While higher percentages of tungsten have been used and occasionally are still employed, modern opinion seems to agree that the maximum efficiency may be obtained with less than about 20 per cent tungsten. The function of the tungsten is to retard the hardening and increase the depth to which the hardening effect penetrates below the surface. It also resists the formation of a large crystalline structure (retaining martensitic structure) and hence tends to produce a keen and durable cutting edge. Chromium in amounts averaging about 4 per cent produces a very hard steel, with a high elastic limit. Vanadium—a very costly alloy—is added in amounts up to 1¼ per cent, in order to obtain greater uniformity of structure and to eliminate oxides and other impurities. Manganese in proportions of about 0.25 is present, toughening the steel without reducing the hardness.

Other tungsten steels.—Fully 90 per cent and probably 95 per cent of the domestic consumption of tungsten enters into the manufacture of high-speed steel. Other tungsten steels, however, are important factors in production. Large quantities of low-tungsten steels are used for finishing work where the speed or depth of cut does not require the same degree of red hardness as is requisite for rapid-roughing work. Tungsten steels are also employed for blanking dies used for sheet-metal working.

Another important product in this class is hack-saw sheet, ordinarily containing about 1¼ per cent of tungsten, and strip of similar composition for band saws, which are now being used to an increasing extent instead of hack saws. The tungsten contents of the so-called "semirapid" and other steels that come between the border lines of high-speed steels and straight carbon or tungstenless tool steels are highly variable, a few of them containing up to 8 or 10 per cent tungsten, although the usual range is between 1 and 4 per cent. Magnet steels average in the middle range of tungsten content between high-speed steel and the low-tungsten steels and contain from 6 to 10 per cent of tungsten.

Tungstenless tool steels.—There is a heavy production of plain carbon tool steels varying in hardness according to the carbon percentages, which range ordinarily from about 0.75 to say 1.45. Occasionally small percentages of vanadium will be added to these steels. Various classes of alloy steels containing relatively small percentages of alloying elements are also used as tool steels.

SUBSTITUTES FOR TUNGSTEN STEELS.

Molybdenum steels have been heralded at various times as the equal of tungsten steels for the manufacture of cutting tools of all sorts, it being claimed that the tungsten may be replaced by over one-third to one-half of the amount of molybdenum. At least one molybdenum high-speed steel is on the market; this is made in England. There seems to be no probability of the early adoption of molybdenum to replace tungsten in cutting tools, owing to the fact that molybdenum steels, as formerly manufactured at least, have a tendency to crumble at high temperatures. Generally they are

variable in quality in different melts and have gained a reputation for not being dependable.

Molybdenum has also been substituted for tungsten and manganese steels, although according to recent experiments, cobalt promises to become a more formidable competitor in this field. Tantalum is another alloy that has been used experimentally instead of tungsten in high-speed steel. In general, however, it may be stated that no satisfactory substitute for tungsten in tool steels which must hold their edge while at a high temperature, has been developed. Stellite, a nonferrous alloy, has proved in many cases a satisfactory substitute for high-speed steel, but this product also ordinarily contains tungsten.[2]

DOMESTIC PRODUCTION.

There are no published statistics of production of tool steel in the United States, and the consumption has fluctuated enormously during and since the war period. Reports from various manufacturers to the Tariff Commission indicate that the output of all classes of tool steel in 1919 was much more than double that of 1914, due partly to general increases in prices, but more especially to a greater increase in the production of the more costly steels. The annual value of the output increased to almost six times during the same period. Production in 1920 was at a reduced rate.

Raw materials.—Raw materials constitute an important item in the production of all classes of tool steels. Only pure materials are used, as it is ordinarily cheaper to start with these rather than endeavor to remove impurities in the process. In the case of ordinary carbon steels, raw material cost will vary from about 25 per cent to 40 per cent or more of the total plant cost of production. Most of the domestic manufacturers purchase their tungsten in the form of ferrotungsten (70 per cent W) or tungsten metal powder from ferro-alloy manufacturers. Some manufacturers use both, but the tendency seems to be to use larger quantities of ferrotungsten. Ferrovanadium, although present in only small amounts, is generally the next most important item in view of its high cost per pound. As regards percentage composition, chromium constitutes the largest percentage of alloy in high-speed steel, next to tungsten, but its value is less than that of the iron, which constitutes about 75 per cent of the total weight and is derived from relatively costly materials, generally wrought iron and selected steel scrap or electric furnace steel.

In England blister steel (made by the cementation process and usually from Swedish iron) is commonly employed in the best grades of high-speed steel. Small quantities of manganese are added, but this is an unimportant factor in cost. Other alloys are used in certain brands of high-speed steel, but this can also be ignored.

The matter of tungsten supply has been widely discussed, and reference should be made to the Tariff Commission's survey on Tungsten-Bearing Ores and on Ferrotungsten. Under present conditions (February, 1921), most of the domestic manufacturers pay lightly more for their tungsten than their European competitors.[3]

[2] See Tariff Commission survey on Substitutes for Tool Steel.

[3] The question of proper compensatory duties in case a duty should be placed upon tungsten ores, will discussed in some detail in this survey under "Tariff Considerations."

In the case of steels which do not contain tungsten the wrought iron or steel scrap will ordinarily be the most important item in raw material cost, although various alloys are occasionally added. The wrought iron is ordinarily purchased in bar form, although a few plants have their own puddling works and purchase only pig iron and scrap.

In the case of steels made by the crucible process as much as 6 tons of fuel are required per ton of product. The cost of crucibles is also a heavy item in melting. According to a domestic manufacturer, French crucibles may be obtained in the United States at $5.50 and will stand twice as many heats as American crucibles which cost $7.

In the electric-furnace process, power and electrodes require consideration as important factors in melting cost, and fuel is also required for preheating the bars between successive reductions of the ingot to finished shapes.

In general, the American manufacturer is little if any handicapped as compared with the foreign producer, in obtaining his requisite raw materials. He has to pay slightly more for ferrochrome, but his vanadium should be cheaper, especially in electric-furnace plants where relatively high silicon alloy may be used. The competitive conditions in other alloys, and particularly those with reference to the supply of tungsten, vary since most of the latter is imported either in the form of ore or alloy. As regards fuel cost, American steel works should have a considerable advantage.

Equipment.—The cost of steel works making tool steels is several times greater per unit of output than that of a steel works making ordinary soft steel. The actual investment in plant and equipment is variously estimated, but as a result of the Tariff Commission's inquiries it would appear that, even in the larger plants, it would amount to fully $250 or $300 per ton of annual capacity. In addition to the investment in plant a large amount of working capital is required, so that probably in the neighborhood of $1,000 per ton of projected annual capacity must be assured before engaging in the business. An important feature is the carrying of large stocks, both of raw material and product. Aside from the necessary buildings and melting plant (either crucible or electric) forging and rolling mills are required, together with a shop for finishing and grinding the final bars. Heating furnaces must be provided in the rolling mills, as these special steels frequently require much higher temperatures for successful reduction than soft steel. The equipment is generally less complicated and not nearly so completely automatic in operation as that commonly used for the bulk production of soft steel; but owing to the small units and the great care that must be given to the different batches the equipment is more costly per unit of output. All of the equipment and machinery used in domestic plants may be obtained from American manufacturers. Similar factories could doubtless be built more cheaply abroad owing to lower construction costs, but the difference is too slight to affect materially the cost of production.

Methods of production.—The better grades of tool steel are manufactured both in the crucible and electric furnace. A few of the cheaper classes of tool steels are also made in the open hearth. So far as can be ascertained no tool steels are made by the Bessemer

rocess in the United States. A large tonnage of tool steel for ining drills, woodworking machinery, and farm implements is pro-uced by the open-hearth process, but all of this steel may be classed s "tool steel" since it must be hardened and tempered. A general utline of the methods of manufacture by these various processes ay be found in the Tariff Commission's survey on Alloy Steels.

The manufacture of tool steels, however, differs from ordinary eel practice in that it is handled in small units and, subsequent to he melting, the operations are much more difficult and more numer-us. As regards the quality of the product made by the crucible nd electric furnace opinions differ, but it can be stated authorita-ively that if sufficient attention is given to details electric furnace ool steel is as good as the best crucible steel. The crucible process, owever, using the purest of raw materials may be more easily man-ged so as to secure the greatest uniformity and highest quality of roduct, and will doubtless continue to be used where the cost of aw materials in proportion to other cost items is high, as in the case f high-speed steel, and where the tonnage sold is not great. Where arger tonnages are involved, even to the extent of many of the heaper classes of tool steels, the electric or open-hearth processes ave already displaced crucible melting. A great advantage of the rucible process where costly raw materials are involved is the com-paratively low melting losses.

Molten steel, however produced, is poured into ingot molds. The size of these ingots will vary according to the material manufactured and the practice at various plants, but invariably these are very much smaller than mild steel ingots or alloy structural steel bulk products. The common size is about 6 by 6 inches, although at some plants a 10 by 10 inch ingot will be cast. After casting, the ingots (according to American practice) are first annealed by heating slowly to a temper-ature of about 1,300° C. and allowed to soak for a time. They are then taken to large steam hammers or blooming mills where th are reduced to billets, commonly 4 by 4 inches. These billets are then chipped all over with pneumatic hammers to remove scale and surface defects, and are frequently pickled in acid so as to reveal seams or cracks. If necessary the tops are cropped at this stage. After chipping, most of the product must be rolled or hammered into the smaller sizes desired by purchaser. On the average, probably three distinct operations are required, each necessitating reheating the material to a temperature fully 300° C. above the common finishing temperature in rolling straight carbon steel (say 900° C.). Occasion-ally steel must be put back in the furnace as many as eight times. Each heating results in a certain amount of scale and involves a loss ranging from about 2½ per cent up. The scale thus formed is of practically no value, although experiments have been conducted with the object of its utilization. When the finished sizes have been obtained the pieces are finally annealed in closed tubes for a period of from 24 to 48 hours and then straightened. A portion of the product may undergo the additional process of cold drawing.

The last operation is inspection, in which it is common practice to crop a piece from both ends of every bar so as to disclose any interior defects after which the entire surface of the bar is lightly ground or finished with a file. The finished bars are then branded or labeled ready for shipment.

On account of the great care required, the amount of labor at each stage of reduction is greater throughout the operation in the case of tool steels than in ordinary steel plants, where American large-scale production methods may be utilized to the full extent. Due to their hardness and difficulty of working, the number of operations is also much greater than in the case of other steels. The average output per man at several American tool-steel works is less than 1 ton per month. For these reasons the labor cost per ton is several times that experienced in the steel works devoted to the bulk production of ordinary mild-steel bars.

Another matter of much importance, especially in the case of the higher tungsten steels, is the amount of scrap. The tops of the ingots are frequently cropped to remove any blowholes or segregations, and between successive stages in the reduction processes it is frequently necessary to remove sections, particularly on the ends which show cracks or flaws.

The amount of finished bars rejected in the final inspection is a much larger percentage of the total output than in most branches of the finished industry. While a large part of this scrap may be remelted, and, except for melting losses of approximately 3 per cent, the tungsten contents may be recovered without much difficulty. Loss in scale, however, is a difficult problem since its alloy contents can not be recovered by returning it directly to the process.

Organization.—There are about 25 manufacturers of tool steel in the United States. Most of these manufacturers make only tool steel, although almost all of them manufacture several grades. The manufacture of trade products and even of the lower grades of tool steels (for example, farm implement steel) is ordinarily the result of the necessity of maintaining operations during periods of slack requirements. At least one firm is employed in remelting the ends and broken parts (scrap) of tools. Only one or two of the American firms manufacture finished tools themselves, and as a rule the domestic manufacturers of tool steels specialize on the conversion of bar iron or mild steel into tool steel. There is little apparent tendency toward integration, either in the direction of manufacturing ferroalloys from their ores or in the direction of making milling cutters, small tools, etc. Some of the establishments are rated as fairly large, but the industry generally does not lend itself to the development of establishments or organizations comparable in size with those of steel companies making ordinary carbon steels. Since the main emphasis is laid upon quality, which calls for frequent inspection as well as skilled technical control, the size of the units is limited even more than is indicated by the actual tonnages involved.

All of the tool steel companies have their own sales organizations. Probably fully 90 per cent of the production is sold direct by the manufacturer to the consumer, most of the trade being done on the basis of personal solicitation and demonstration.

History of the industry.—On account of its long experience in the manufacture of crucible steel, Sheffield, in England, has been able to maintain the best quality of tool steels for many years. Tungsten was used commercially in steel by Mushet, who developed an ore-hardening steel in England in the sixties. It is difficult to determine the various phases in the evolution of this product, the high-speed

eel which resulted from the special heat treatment discovered by
e Americans, Taylor and White, at the close of the nineteenth cen-
ry. The tungsten steel used is relatively high in carbon, while
anganese was then employed in larger proportions than now,
though even then it was being replaced by chromium. The intro-
uction of vanadium as a stabilizer with the consequently greater
niformity of product was distinctly an American discovery, due to
e genius of Dr. John A. Mathews, who took out his patents in Janu-
ry, 1905.

The manufacture of carbon-tool steels in the United States was well
dvanced toward the latter part of the nineteenth century, and this
ountry had to import only a few classes of special steels that were
ot then manufactured in the United States. Prior to the war, how-
ver, many of the tungsten steels made in the United States were of
nferior quality to those of English manufacture. Even before the
ar, however, Sheffield's hold on the American market had been
hallenged by several American companies, and during the war the
indrances to getting British steel fostered the growth of the American
ndustry and served to introduce American brands to domestic users
ho have declared them to be the equal of the best made abroad.

The emphasis laid upon quantity production and the greater atten-
ion given to efficient shop management resulting from the requirements
or the manufacture of munitions greatly stimulated the use of high-
peed steel. Much of the work formerly done by carbon-steel tools is
ow done by only about one-fifth the labor and equipment formerly
equired, due to the extraordinary properties of these new steels.
While high-speed steel has to some extent displaced carbon steels in
he cutting of metals, the use of high-grade carbon steels of the tool-
teel class which can be hardened and tempered has also increased.

The use of the electric furnace, which is an extremely important
actor in reducing the cost of production of high-grade steels, is dis-
inctly an American development in this industry. This process has
ot been adopted abroad for the manufacture of high-speed steel
nd to only a very limited extent in the manufacture of other tool
teel, whereas by far the larger part of the American output is now
nade in the electric furnace.

Domestic production and consumption.—All classes of steel which
are required in American industry may be supplied from domestic
plants. The capacity of domestic tool-steel works is probably fully
double present requirements, having been expanded largely during
the war. This necessitates the production in these works of many
cheaper grades of steel as the filler.

Domestic exports.—A small amount of tool steel is known to have
been exported during the war, but under normal conditions very
little high-grade steel is exported, the trade being confined almost
wholly to Canada. There is some export of finished tools, twist drills,
etc., particularly in the plain carbon grades, but as these products
are not made generally by domestic tool-steel companies the exports
of tool steel may be considered negligible. American manufacturers
assert that they are at a marked disadvantage in foreign countries
as compared with British and German steel, owing to their distance
rom these markets, which would necessitate carrying large stocks,
nd due to the fact that the foreign steels are always cheaper. The
act that these steels are sold direct to the consumer by personal
olicitation is a factor.

FOREIGN PRODUCTION.

Tool steels have been manufactured in considerable quantities in England, Germany, Austria, and Sweden. The French production has been unimportant in the past, but the reorganization of the steel industry in that country, together with cheap electric power and raw materials, may result in France becoming a larger factor in the world trade in special steels of all kinds. Belgium, in spite of its output of machine tools, has not supplied any large quantity of tool steel. The type of foreign competition in the American market differs greatly according to the country of origin. English steel is sold in this country almost wholly on account of its reputation, and is of high quality.

Formerly Sheffield steel was much better than any quality made in the United States, and is now fully equal to the best American production. Competition from Germany and Austria, which were the next largest foreign producers prior to the war, was due wholly to lower prices and the practice of selling steel on consignment, offering extended terms of payment. Swedish steel was also sold more cheaply in the United States than domestic. Data with regard to the continental tool-steel production since the outbreak of the war are not available.

England is the largest foreign producing country and, until the last year or two, the British output exceeded that of the United States, increasing from about 6,000 tons a year before the war to a maximum of 18,000 or 19,000 tons in 1918. The production of tool steel in England is concentrated in the city of Sheffield, where there are at least 150 different firms in the crucible-steel business. About 20 of these firms are large producers, but many of the smaller works merely operate melting plants, sending out their ingots to custom rolling mills.

A great deal of the Sheffield output passes through three separate organizations: (1) Melting works, (2) custom cogging or rolling works, and (3) warehouses in which steels are inspected, annealed, and branded for sale. There is also a large works at Openshaw, a suburb of Manchester, where tungsten and other tool steels, as well as milling cutters, twist drills, and other finished small tools, are manufactured. Several of the Sheffield firms also are integrated to the extent of making finished tools as well as bars. The crucible process is used in England almost exclusively, and British practice in the manufacture of these steels is much more efficient metallurgically than American practice, although a much larger amount of human labor is required.

British manufacturers are at least as favorably situated as American manufacturers as regards their supplies of raw materials, and these are almost invariably slightly cheaper delivered at Sheffield works than at the average American plant. Fuel (coke) is more costly and the present trend would indicate the maintenance of materially higher levels in England than in the United States. Prior to the war British wages in this industry were only about one-half those paid in the United States for similar classes of work, and British wages in crucible-steel making are still much lower than those paid in American plants, in spite of the large advances that have been made in England since 1914.

Of special significance in the manufacture of these steels is the relatively low wages paid to rollers and hammer finishers, since it is in this branch of the work that labor is the main factor in cost.

British labor costs at present, however, are much greater than comparative wages would indicate, owing to the relatively small units of production (the average crucible charge is only 60 pounds) and comparative lack of mechanical equipment in the finishing mills, combined with the lowered efficiency of the workers since the war. Fuel costs in November, 1920, were about $10.60 (exchange at $3.40), or approximately the same as in the United States. In February, 1921, however, coke was selling in England at 55s. ($10.56 at existing exchange), whereas it was offered at from $4.50 to $7 in different steel centers in the United States.

There was a considerable accumulation of stocks of various classes of tool steel in England at the signing of the armistice, and these have not (February, 1921) yet been entirely disbursed. The production of tool steels in England has declined to approximately 50 per cent of the maximum war-time output but is still materially in excess of domestic (British) requirements and might be very greatly expanded.

Germany and Austria before the war both exported a fair amount of tool steel, especially steels with medium percentages of tungsten. German tool steel never attained the popularity that Sheffield steel has always enjoyed. Hence, although Germany supplied the Sheffield manufacturers with tungsten metal powder and a certain amount of ferrotungsten, Germany was at some disadvantage in foreign markets and was forced to sell at lower prices and frequently to give extended credit. According to the general understanding in the trade, government assistance—notably in the matter of freight rates—was also given the German steel manufacturers.

The war wrought a complete disorganization of the German industry, since it was absolutely impossible for the Central Powers to obtain adequate supplies of either tungsten ore or metal. Under the war necessity German steel makers first turned to molybdenum high-speed steel, obtaining molybdenum ore from Norway until the supply of this metal was cut off, owing to the purchase of the Norwegian output by the British and American Governments. Later a 10 per cent tungsten steel is reported as having been developed, but apparently none of the German war-time substitutes have come upon the market since the war. While German firms have lately (October, 1920) come into the ferroalloy market again, no German competition has been yet reported to the tool steel trade (February, 1921).

IMPORTS.

The imports of tool steel are included under three classifications in the records of the Department of Commerce, but each of these classifications also covers all classes of alloy steels; hence it is impossible to present statistics that will accurately show the actual importations. An examination of the original invoices under these various classifications made by a representative of the Tariff Commission at the New York customhouse showed that nearly all, if not all, the imports under these classifications in 1920 were tungsten steel and consisted very largely of high-speed steel, all of which was derived from England.

Hack-saw sheet containing tungsten was another important item which comes under the Commerce designation "sheets and plates when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise." An agent of the Tariff Commission also examined the records at the United States consular office in Sheffield, England, and noted that practically all the exports of steel through that office during the past six years consisted of tungsten steel of various grades. There was also some export of finished tools, twist drills, reamers, etc., made from high-speed steel which passed through the Sheffield consular office, although all classes of these articles are also invoiced through London, Liverpool, and Manchester.

It would, therefore, appear that the import statistics for alloy steels yield a fair indication of the importation of all classes of tool steel, and in fact very nearly represent the importations of tungsten steels. The complete statistics will be found in the Tariff Commission's survey on alloy steels, but the figures at the head of page 112 summarize the import trade in recent fiscal years:

PRICES.

As practically all domestic tool steel is sold direct to the consumer, there are no wholesale prices, and the market is not quoted regularly in the trade publications. The Tariff Commission, however, has received statements from all the largest American manufacturers as to their prices on various grades of these steels since 1913. A compilation of these figures will be found in the statistical tables, infra. Referring to these tables, it will be noted that the prices in 1914 ranged from 6 or 7 cents for plain carbon tool steels up to 66 cents per pound for high-speed steel, whereas in 1920 the range was from 17 cents for the cheapest grade to approximately $1.25 for high-speed steel. The prices of tool steels are for based sizes in each grade and usually either in round, rectangular, or octagonal bars of specified lengths. Extras are added to the base prices for extra sizes.

In the latter half of 1920 and early in 1921, concessions have been made from the public prices as given in the statistical tables. Sales of high-speed steel of domestic make have been reported to the Tariff Commission at 86 cents per pound to large consumers, although the general market is given in the neighborhood of $1.15. The importers report difficulty in selling British steel in the American market at competitive prices, in spite of the depreciated exchange. In October, 1920, crucible cast steels from Sheffield were invoiced to the importer at 124s. per hundredweight, which was equivalent to approximately 22 cents per pound. A lower grade billed against the importer at 105s. cost 19 cents, duty paid. It is asserted by the importer that similar grades of steel could be bought from American mills at 14 cents a pound. Saw sheet in the latter half of 1920 was billed to the importer at 120s. per hundredwieght, less 2½ per cent, which was stated to permit the sale of only small quantities and with little profit in competition with the American product.

Only meager information is available as to prices in Germany. One importer, however, reports that German high-speed steel containing 16 to 17 per cent tungsten, but with only 0.3 per cent vanadium (as compared with 1 per cent generally demanded in this country) was obtainable at 80 cents per pound, duty paid New York

xtras, however, on smaller sizes of German material, as in the f English material were great, adding from 5 per cent up to 30 nt to the base price.

ill be noted that even the cheapest grades of tool steels sell for l times the price of ordinary steel bars. In February, 1921, r tool steel is quoted by various manufacturers at about 17 per pound, whereas ordinary merchant steel bars were quoted 5 to 2.35 cents per pound. British prices are ordinarily higher hose in other European countries, but have ranged much under can quotations. During the war period the price and sales of peed steel were regulated by the minister of munitions. In ry, 1918, the controlled prices on finished bars were 4s. 5d.) per pound for 18 per cent tungsten steel, and 3s. 8d. ($0.87) ound for the 14 per cent grade. Following the removal of l in early 1918, the prices for the lower grades of high-speed leclined, selling at the end of the year at 3s. 6d. and 2s. 11d., tively, per pound, delivered at buyer's works in England. In however, high-speed steel prices were increased almost up to ır-time control levels, the standard quotations during the latter f the year being 4s. 3d. for 18 per cent and 3s. 6d. for 16 per British base prices are on rounds and squares from 2½ inches 3 inches, as compared with the American range of ⅝ inch to 2 . The extras, however, average higher than American losses, arkable feature being the larger extra charge on heavier sec-

WAGES.

no branch of the iron and steel industry are wages so large a in the total cost of production as in tool steel plants. By of questionnaires, the Tariff Commission has received state- as to wages paid in various American plants in 1920 and prior war (1914). Methods of payment vary in the different mills he increases in different plants have been variable, so it is sible to present in tabular form average increases that will represent the conditions throughout the industry. In general, y be said that common labor, which before the war received en 15 and 20 cents per hour, received in 1920 from 45 to 60 per hour. Melters were one of the best-paid classes of workers 4, receiving on time work 60 cents per hour or more, whereas 20, their wages were over $1. Melters, however, are more only paid on a tonnage basis—generally about $16 a ton in which is about double the prewar rate. Finishing rollers and er men are ordinarily the best-paid workers at present, receiving $2 per hour in some plants.

M. Tyler, The Iron Age, Feb. 10, 1921.

The following tabulation as given by a large company in Pennsylvania is selected as being most nearly representative:

Comparative wages per hour at an American tool steel works.

Class.	Prewar.	1920.	Increase.
			Per cent.
Common labor	$0.15	$0.46	207
Melters	.61	1.02	67
Pot pullers	.31	.62	100
Rollers	.65	1.52	134
Heaters	.25	.75	200
Roughers	.22½	.72	220
Hammer crews	.25	.65	160
Inspectors	.17½	.50	186
Annealers	.17½	.50	186
Chippers	.16	.49	206
Clerical	.17½	.55	214

COSTS.

On account of the diversity of products manufactured in tool steel plants, it would be difficult to ascertain the average cost throughout the United States of producing any single class of these steels. While complete records are kept at certain plants, the distribution of general expenses and even of much of the direct labor and materials depends upon individual accounting methods. Owing to the unsettled conditions since the war (while many companies were carrying large stocks of expensive raw materials acquired at high prices) and because of the fact that most of the plants were operating at much below normal during part of the years, the Tariff Commission has not instituted a general cost investigation. Questionnaires were, however, sent out in order to obtain statements from manufacturers as to the general distribution of costs. As will be seen from the following table, the replies that were received indicated that a general investigation would be fraught with some uncertainty.

Distribution of production costs at American plants.[1]

Class of tool steel.	Company.	Per cent of total cost.			
		Labor.	Materials.	Fuel and power.	Other direct charges.
All classes	A	55	30	8	7
Do	B	55	35	7½	2½
Do	C	37	38	8	17
Do.[2]	D	10	70	15	5
Carbon tool steel	E	29	20	6	45
Do	F	25	40	5	30
High-speed steel	E	17	59	4	20
Do	F	30	60	7½	2½

[1] Replies to Tariff Commission's questionnaire.
[2] Includes some cheaper grades of alloy steel.

The great variation in the percentage distributions of cost may in large part be attributed to differences in the proportions of the different classes of tool steels produced at the various plants. Another factor, however, is the character of the raw material purchased.

n the case of ordinary tool steel, it is possible for plants to utilize ar iron of either Swedish or domestic origin, together with varying ercentages of steel scrap. At certain domestic plants, where there re puddling works, pig iron is the material purchased, thereby elimiating external profits in the conversion of this material into muck ar. Taking cost of pig iron for the period under consideration at 45 per ton, it would represent roughly 2 cents per pound for the cost f this raw material, whereas wrought iron in the open market costs ully 5 cents. In the case of tungsten steels, the difference in price f tungsten metal powder and that of ferrotungsten is a factor. Both are used at many American works, but most of them use chiefly the ferro-alloy, the tungsten contents of which will be cheaper.

LOSSES.

In the case of tungsten steels especially, the matter of wastage in the process of conversion from raw material into finished bars is of much importance. A certain amount of raw material is of necessity lost—first, in melting, and, second, in each of the mechanical operations incidental to reducing the ingot to the finished product.

Melting losses vary according to the process employed, being always greater in the electric furnace or open hearth than in the crucible. A recovery of about 97 per cent of the weight of the raw materials charged may be considered average good work in the crucible process, whereas in the electric furnace 88 to 90 per cent is perhaps a more common figure. Losses of alloys in melting are ordinarily greater than those of iron, not only in dollars and cents but also in percentages of the total charged. For low-grade alloy steels in the open-hearth process 6 per cent may be a fair average loss. One company (using both crucible and electric methods of melting) reports to the Tariff Commission that in melting high-speed steel its tungsten losses are 15 per cent, chromium losses 25 per cent, vanadium 25 per cent, and a total loss of 7½ per cent (including the alloy losses). Entire ingots must occasionally be scrapped and remelted, owing to analysis being unsatisfactory.

Losses in the mechanical operations are of two classes—scrap and scaleage. The scrap losses are chiefly of material cropped from the ends of the ingots or bars and may generally be remelted and a large part of its raw material value recovered. Scaleage, however, is an oxidation loss which varies with the temperature, time of exposure to the air, and surface area. Owing to the fact that tool steels generally are much harder and more difficult to work, the amount of draft or reduction in cross section permissible in one heat will be less than in mild steel; consequently the scaleage losses are greater. Manufacturers report varying percentages, the average being probably about 13 per cent scaleage in high-speed steel and 9 per cent in carbon steel, these figures representing a total loss of material. Some companies report a total gross loss of as much as 60 per cent from ingot to finished material on high-speed steel, as compared to the total loss of only 30 to 35 per cent in carbon tool steels.

TARIFF HISTORY.

Tool steels have been grouped with other classes of steels in tariff acts before 1913. The first mention of alloy steels was in the act

of 1913 when they were made dutiable at 15 per cent, as were also all other steels made by the crucible, electric, or cementation process. Tool steels not containing alloys if made by the Bessemer or open-hearth process are dutiable at 8 per cent ad valorem. Specific duties on a sliding scale were provided in the previous acts.

COMPETITIVE CONDITIONS.

The main factors affecting the competitive position of the manufacturers of tool steels are raw materials and labor. Fuel and power costs and general charges per unit of product are of minor importance, and may be assumed to be practically equal in all competing countries. As regards supplies of raw materials, with the exception of tungsten, the American manufacturer under normal conditions is on a very nearly equal footing with his competitors in Germany, Austria, and Sweden. Under these conditions it would appear that in the raw-material costs in the production of plain carbon steel, and, in fact, of all tool steels (other than those containing tungsten), American manufacturers are not handicapped. Tungsten, however, has been almost invariably more expensive in the United States than in the countries mentioned. During 1920 American steel companies purchased the greater part of their tungsten abroad, since they found it cheaper to buy British and, latterly, German metal powder or ferro, than to purchase it from domestic manufacturers or (in certain instances) make it themselves from ore offered on the domestic market.

Labor, in these high-grade steels, is the most important item to be considered in comparing the relative advantage in the foreign and domestic industries. Wages in the United States are materially higher than those in foreign countries, and the general difference in wage levels correspond more or less with those obtaining in other branches of the iron and steel trade. Skilled labor, however, is used to a much larger extent in the manufacture of tool steel than in ordinary steels. The production of tool steels is a handicraft industry compared with modern bulk production of mild steel. For this reason American efficiency in organization and equipment has not served to offset the difference in foreign and domestic wages to the same degree as it has in the soft-steel industry.

Transportation in the case of these more costly steels is a less important factor than in the heavier lines, although the recent practice of charging ocean freight on an ad valorem basis (2 per cent in the latter half of 1920) has afforded some protection to domestic manufacturers of high-speed steel. The importers of foreign steel, on the other hand, are faced with the necessity of maintaining warehouses and considerable stocks in the United States, necessitating a heavier selling expense against their American sales as compared with domestic companies.

TARIFF CONSIDERATIONS.

In the administration of the tariff act of 1913 the customs officers have experienced great difficulty in establishing without question the character of process by which steels were originally manufactured. The tariff designation requires that this be done. The main

ifficulty is in determining whether or not a steel is made in the pen-hearth or in the electric furnace. When sufficient care is de- oted to the operations—at least in the cheaper grades of tool steel— n equally good quality of steel may be made in the open-hearth as the electric furnace, or in the crucible. High-grade steels have so been made in Sweden from extraordinarily pure ores by the essemer process (the carbon being caught coming down). Such eels, under the tariff act of 1913, may be dutiable at 8 per cent, lthough competing with steels made in the electric furnace or cru- ble, which are dutiable at 15 per cent. The suggestion is made at the distinction between high-grade steels and ordinary steels be ased upon the carbon contents, which can be satisfactorily ascer- ined by standard methods of mechanical analysis. The bulk trade done in steels containing 0.35 per cent or less of carbon, whereas ractically all tool steels and most of the high-grade steels used in rings, hard wire, etc.. contain 0.60 per cent or more of carbon.

The suggestion of a duty on tungsten-bearing ores raises the ques- on of compensatory duties on tungsten steel, and especially on igh-speed steel. The Tariff Commission has endeavored to discover verage tungsten losses in the preparation of tungsten powder and rrotungsten, and again in the manufacture of tungsten steel. On ccount of variations in the character of the ores treated, the losses conversion from tungsten ore to ferroalloy were found to be highly ariable. Again, the wastage of tungsten in the manufacture of alloy teels also varies widely between different companies, and in the same lant between steels of different tungsten content. As a rule, it ay be said the tungsten losses in the case of a high-speed steel will e considerably greater than in the case of low-tungsten steels. In iew of these difficulties the following question was directed to the ool Steel Society, which includes practically all the large tool-steel akers in this country:

> Assuming a theoretical duty of $1 per pound of tungsten content on ferrotungsten tungsten metal powder, what would be a proper and adequate compensatory duty your product merely to repay you for the additional cost of raw material and put u on the same footing as foreign manufacturers?

The replies to this question indicated a division of opinion. Several anufacturers urged that 25 cents per pound on steels containing 12 er cent or more of tungsten would be "sufficient." One manufac- rer gave 30 cents per pound. Others suggested 1½ cents per ound of steel for each 1 per cent of tungsten contained therein. he minimum estimate was 1¼ cents per pound for each 1 per cent of ngsten contained in the steel. Almost all members of the society ere opposed to any change in the duties on their raw materials, and serted that with tungsten ore on the free list and tungsten metal d ferrotungsten dutiable at 15 per cent, the "proper" duty on gh-speed steel is 35 per cent ad valorem.

The matter of determining the value of tungsten steels generally nges especially upon the tungsten content, which in questionable ses can be obtained by chemical analysis. For distinguishing tween fairly high-tungsten steels and carbon and other alloy eels, a physical method—the spark test—may be applied. Even experienced hands, however, this test could probably not be relied on for determining the degree of tungsten content.

IMPORTS FOR CONSUMPTION—REVENUE.

Alloy steel.

Fiscal years.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	15 per cent	15,651,380	$1,765,635	$264,845.25	$0.113	15.00
1915	do	13,157,192	1,410,712	211,606.80	.107	15.00
1916	do	11,888,828	1,670,296	250,544.40	.14	15.00
1917	do	9,730,005	1,497,228	224,584.20	.154	15.00
1918	do	7,089,687	1,357,221	203,583.15	.191	15.00
1919	do	7,004,182	2,271,155	340,673.25	.324	15.00
1920	do	8,926,777	3,292,752	489,412.80	.366	15.00
1919 [2]	do	6,660,214	2,870,033	430,504.95	.431	15.00

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar year.

Steel billets (except Bessemer, etc.), and bars and tapered or beveled bars (merchant bar), if made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.

Fiscal years.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1919	15 per cent	4,961,968	$1,343,017	$201,452.55	$0.271	15.00
1920	do	4,848,650	1,557,122	233,568.30	.321	15.00
1919 [2]	do	3,137,031	1,181,044	177,156.60	.377	15.00

[2] Calendar year.

Steel ingots, cogged ingots, blooms and slabs; die blocks or blanks; billets and bars and tapered or beveled bars, pressed, sheared, or stamped shapes, not advanced in value or condition by an process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun barrel molds not in bars; alloys used as substitutes for steel in the manufacture of tools; all descriptions and shapes of dry sand, loam, or iron-molded steel castings; and steel n. s. p. f. if made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise.

Fiscal years.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	15 per cent	15,651,380	$1,765,635	$264,845.25	$0.113	15.00
1915	do	13,157,192	1,410,712	211,606.80	.107	15.00
1916	do	11,604,969	1,624,248	243,637.20	.14	15.00
1917	do	9,286,740	1,426,423	213,963.45	.154	15.00
1918	do	6,048,579	1,271,946	190,791.90	.210	15.00
1919	do	1,817,633	803,815	120,572.25	.442	15.00
1920	do	3,497,250	1,433,597	215,039.55	.41	15.00
1919 [2]	do	3,318,726	1,566,025	234,903.75	.472	15.00

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar year.

by whatever process made, n. s. p. f., containing alloys, such as nickel, cobalt adium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, alum, boron, and similar alloys.

cal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
	15 per cent	283 859	$46 048.00	$6 907.20	$0.162	15.00
	do	443 265	70 805.00	10 620.75	.160	15.00
	do	1 041 108	85 275.00	12 791.25	.082	15.00
	do	224 581	124 323.00	18 648.45	.553	15.00
	do	580 877	272 033.00	40 804.95	.468	15.00
	do	204 457	122 964.00	18 444.60	.601	15.00

lendar year.

PRICES.

Tool steels, per pound (as sold by makers to consumers).

[Data from replies to Tariff Commission's questionnaire.]

Grade.	1914	1915	1916	1917	1918	1919	1920
ar carbon	$0.065–$0.080	$0.08	$0.09–$0.105	$0.12–$0.14	$0.15–$0.16	$0.15–$0.16	$0.15–$0.18
tool	.13	.14	.16	.17– .18	.18– .20	.18– .20	.19
al tool	.14 – .16	.14–.17	.15– .21	.18– .23	.22– .23	.22– .23	.24
rdening							.35
tungsten (1 to 2 cent)							.27
inishing	.28						.67¢
llaneous	.19	.19	.22	.25	.31	.33	.33
speed	.525– .66	.78– 2.40	2.09– 2.40	2.00– 2.44	1.80– 2.02	1.60– 1.65	1.15– 1.25

SUBSTITUTES FOR TOOL STEELS.

SUMMARY.

At the present time the only commercial substitute for tool which comes within the provisions of paragraph 110 of the act of 1913 is "Stellite," a patented alloy of cobalt and chrom which is mainly used in the form of a nonmalleable alloy wi hardening agent, generally tungsten, although malleable alloys made which are used in some quantity for noncorroding tablew cutlery, surgical instruments, etc. A similar alloy is offered substitute for platinum in chemical ware, etc. Stellite is manu tured exclusively in the United States and Canada, with only company operating in each country, but similar alloys with properties may be produced in foreign countries and imported the United States if a sufficient demand develops.

All the constituent metals are imported or prepared in the Un States from imported ores. While some export trade is done, alloy has not yet been introduced as extensively in foreign coun as in the United States.

Except for the existence of patent rights, the tariff considerat in connection with these alloys are the same as those in connec with alloy steel and particularly high-speed steel, which is the peting article.

GENERAL INFORMATION.

Paragraph 110, tariff act of 1913: "* * * alloys used as stitutes for steel in the manufacture of tools; * * * 15 centum ad valorem."

DESCRIPTION.

Various alloys of the different nonferrous metals have been us substitutes for steel in ordinary tools and implements. An these may be mentioned bronze, nickel silver (German silver), certain brasses, together with a host of special alloys, many of patented, which have found no extensive commercial use. S most of these contain copper or nickel, or both, they are more sp cally provided for elsewhere in the tariff and do not come w the meaning of the above paragraph. Their other uses, also, much more important than their occasional application as substi for the much cheaper steel.

Apparently the only alloys which do come within the meanin the above paragraph are substitutes for high-speed steel and tool steels, and of these "stellite" is the only one which has achi any appreciable commercial application, although somewhat sim alloys have also been developed. There are special variation stellite as, for example, "superstellite" which is a remelted allo which certain additional ingredients have been added and for w special qualities are claimed.

Stellite is a patented alloy, consisting essentially of cobalt and hromium in proportions ranging from 60 per cent cobalt and 40 er cent chromium to 40 per cent cobalt and 60 per cent chromium.[1] 'or the manufacture of cutting tools a hardening agent is usually dded. In commercial alloys this is almost invariably tungsten in mounts up to about 25 per cent of the total alloy. Molybdenum as also been tried, but has been found to give more or less erratic esults and further experimentation is requisite before it can be ubstituted for tungsten.

Stellite was discovered and originally manufactured by Ellwood laynes at Kokomo, Ind. The Haynes Stellite Co. has now been aken over by the Union Carbide interests who are now the sole nanufacturers in the United States. Stellite was also manufactured n Canada. Haynes formerly was financially interested in the Deloro melting & Manufacturing Co., which is the main cobalt-producing nterest, but there is now no apparent financial connection.

Cutting tools made from stellite have a much greater capacity than ven the best grades of high-speed steel. They can not be formed asily and are brittle, but it has been shown in various tests that as nuch as five times as much metal can be cut off in the same time as by means of high-speed steel, or probably 25 times as rapid cutting an be done with stellite tools as with ordinary carbon tools. Special nachines must ordinarily be designed to use stellite effectively, but n quantity production of standard parts, it is claimed that stellite ools will save at least two lathes and two operators.

Examples are cited of stellite tools that could not be used in an rdinary lathe, but which rendered excellent service when the work as operated at exceptionally high speed. No lubricants are used ith stellite, as it cuts better when red hot. In addition to its use l tools for cutting metals a variety of stellite may be used for table- are, surgical instruments, cutlery, etc., since it resists corrosion and tains a good cutting edge. A similar alloy is also offered as a sub- itute for platinum in chemical apparatus, jewelry, and other appli- tions.

A ferrous alloy containing various amounts of stellite alloyed with on and sold under the name of "Festal" metal (cf. Fe = iron and al = stellite) is used for cutlery. This alloy resembles stainless eel, but is claimed to have superior cutting qualities. But this loy is, of course, a variety of alloy steel rather than a substitute for ol steel.

DOMESTIC PRODUCTION.

According to Mr. Haynes [2] stellite was used for rough turning 75 er cent of the shrapnel made in the United States during the late ar, and during the last year of the war about $3,000,000 worth of ellite was sold principally for war purposes.

The whole world production is made at Kokomo, Ind., and at eloro, Ontario. The domestic output varies widely according to e demand and has fallen off materially since the war, when, as in e case of high-speed steel, the demand reached its maximum. nce practically the whole American supply of metallic cobalt is

[1] In high-speed cutting tools generally the high cobalt alloys are employed.
[2] Raw Material, November, 1920, p. 213.

consumed in the manufacture of stellite, an approximate idea of the output of the latter may be ascertained by multiplying the apparent consumption of cobalt metal by two. The figures are given in the following table:

Year.	Cobalt metal imports.[1]	Stellite estimated production.
	Pounds.	*Pounds.*
1915	53,375	107,000
1916	136,770	274,000
1917	225,171	450,000
1918	504,401	1,009,000
1919	77,556	155,000

[1] Includes "ores and zaffre," as well as metal, but imports of the former have been negligible since 1914.

The raw materials for stellite in order of their importance are cobalt, chromium, and tungsten. The main supply of these metals must be imported. Cobalt is imported from Ontario in the form of metal, which is on the free list (1913), although the cobalt oxide from which it is made is dutiable at 10 per cent. A small amount of cobalt is obtained at Fredericktown, Mo., at a plant owned and operated by the chief Candian interest. A cobalt mine was opened up by the Haynes Stellite Co. in Idaho, but was shut down as unprofitable. If a greater demand developed, however, a considerable supply of cobalt could be recovered as a by-product from refining copper and nickel ores in this country. Chrome metal is manufactured from imported ores by the same company. Stellite manufacturers are in the same position as the high-speed steel makers with regard to their supplies of tungsten.

FOREIGN PRODUCTION.

The only foreign producer is the Deloro Smelting & Manufacturing Co., at Deloro, Ontario. A small amount of stellite has been manufactured at various times in other countries, but the foreign output, outside of Canada, is negligible, and the patent rights to manufacture were owned by the original American company.

EXPORTS.

A certain amount of stellite, chiefly in the form of finished tools, is exported. The probable markets are the same as those for high-speed steel, viz, England, Germany, France, Canada, Belgium, and Switzerland.

IMPORTS.

Stellite has never been largely imported even from Canada, and, so far as can be learned, no other substitute for steel has been imported; certainly not in any great quantity.

PRICES.

The standard grade of stellite in 1920 was quoted at $7 per pound, as compared with approximately $1.15 per pound for high-speed steel (October, 1920). Other grades are furnished at $6 and $8, respec-

ely, per pound; but these are to special specifications of tool anufacturers.

TARIFF HISTORY.

Provision was made for substitutes for tool steel in the tariff act of 83 and in all subsequent acts. Specific rates were adopted in the ts prior to 1909, the duties being based on a sliding scale, increasing th the value per pound. In 1909 alloy substitutes were dutiable at per cent, when valued at over 40 cents per pound. In 1913 the rious classes of steel made by the crucible, electric, and cementa- on processes, together with alloy substitutes for tool steel, were ouped under an ad valorem duty of 15 per cent.

COMPETITIVE CONDITIONS.

As a patented article stellite is not subject to extensive competi- on, except from foreign plants owned or licensed by the original mpany. There is, however, the possibility of similar alloys being veloped by foreign manufacturers which will have similar prop- ties and still come without the range of composition protected by isting patents.

TARIFF CONSIDERATION.

The inclusion of these nonferrous alloys in paragraph 110 with eel is somewhat anomalous, although as substitutes for tool steel ey should receive similar consideration.

PRODUCTION IN UNITED STATES—STATES AND CITIES.

Substitutes for tool steels: No statistics available.

RATES OF DUTY.

Substitutes for alloy steels.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
....	177	* * * alloys used as substitutes for steel tools: * * * all of the above classes of steel not otherwise specially provided for in this act, valued at four cents a pound or less.	45 per cent ad valorem.
		in this act, valued at four cents a pound or less.	
		Above four cents a pound and not above seven cents per pound.	2 cents per pound.
		Valued above seven cents and not above ten cents per pound.	2¾ cents per pound.
		Valued at above ten cents per pound.....	3½ cents per pound.
....	146	* * * alloys used as substitutes for steel tools: * * * all of the above valued at one cent per pound or less.	$\frac{4}{10}$ of 1 cent per pound.
		Valued above one cent and not above one and four-tenths cents per pound.	$\frac{4}{10}$ of 1 cent per pound.
		Valued above one and four-tenths cents per pound and not above one and eight-tenths cents per pound.	$\frac{4}{10}$ of 1 cent per pound.
		Valued above one and eight-tenths and not above two and two-tenths cents per pound.	$\frac{4}{10}$ of 1 cent per pound
		Valued above two and two tenths cents, and not above three cents per pound.	$1\frac{2}{10}$ cents per pound.
		Valued above three cents and not above four cents per pound.	$1\frac{4}{10}$ cent per pound.
		Valued above four cents and not above seven cents per pound.	2 cents per pound.
		Valued above seven cents and not above ten cents per pound.	$2\frac{2}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	3½ cents per pound
		Valued above thirteen cents and not above sixteen cents per pound.	$4\frac{2}{10}$ cents per pound
		Valued above sixteen cents per pound.....	7 cents per pound.

Substitutes for alloy steels—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1894....	122	* * * alloys used as substitutes for steel in the manufacture of tools; * * * all of the above valued at one cent per pound or less.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one cent and not above one and fourteenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and four-tenths cents and not above one and eight-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above four cents and not above seven cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above thirteen cents and not above sixteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above sixteen cents per pound	$4\frac{1}{10}$ cents per pound.
1897....	135	* * * alloys used as substitutes for steel in the manufacture of tools; * * * all of the above valued at one cent per pound or less.	
		Valued above one cent and not above one and four-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and four-tenths cents and not above one and eight-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above four cents and not above seven cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	2 cents per pound.
		Valued above thirteen cents and not above sixteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above sixteen cents per pound	$4\frac{1}{10}$ cents per pound.
1909....	131	* * * alloys used as substitutes for steel in the manufacture of tools; * * * all of the above valued at three-fourths of one cent per pound or less.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above three-fourths of one cent and not above one and three-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and three-tenths cents and not above one and eight-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above one and eight-tenths cents and not above two and two-tenths cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above two and two-tenths cents and not above three cents per pound.	$\frac{1}{10}$ of 1 cent per pound.
		Valued above three cents per pound and not above four cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above four cents and not above seven cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above seven cents and not above ten cents per pound.	$1\frac{1}{10}$ cents per pound.
		Valued above ten cents and not above thirteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above thirteen cents per pound and not above sixteen cents per pound.	$2\frac{1}{10}$ cents per pound.
		Valued above sixteen cents and not above twenty-four cents per pound.	$4\frac{1}{10}$ cents per pound.
		Valued above twenty-four cents and not above thirty-two cents per pound.	6 cents per pound.
		Valued above thirty-two cents and not above forty cents per pound.	7 cents per pound.
		Valued above forty cents per pound	20 per centum ad valorem.
1913....	110	* * * alloys used as substitutes for steel in the manufacture of tools * * * all the foregoing, when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, and all steels by whatever process made, containing alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	15 per centum ad valorem.

DIES, DIE BLOCKS, ETC.

Summary.

are so varied in character that the term "die" conveys little
g. Generically, the word signifies block or cube. In present-
age it has come to mean, in a broad sense, articles employed
form to or make impressions on other articles. In their un-
l form dies are known as blanks or blocks.
may be divided into four general classes: (1) Drop forging or
g dies, (2) wortle or (wire-drawing) plate, (3) embossing dies,
) lettering dies. The first are made in pairs, one of the pieces
ıttached to the hammer or press head of a forging or shaping
ıe and the other forming the anvil or lower die. The second
rforated plates made of high-carbon steel, or in some cases
ted rough diamonds set in metal through which wires are
The third and fourth are plates or blocks having engraved
ossed surfaces or letters and figures and used for making im-
ns on metals or other articles.
e are no available statistics on domestic output, imports, or
. The domestic production is known to be large and suffi-
or home consumption. Some producers report exports but
ount is apparently small.
orts are also insignificant. One reason why they are small is
es are highly specialized products, requiring prompt delivery
ten a close communication between manufacturer and con-
in order to meet the need of the peculiar designs demanded
user. Before the war there was some importation of bars for
ed in forming jewelry and silverware, and this importation has
to some extent since the signing of the armistice.
bars used in the manufacture of dies are cheaper in the
States than in competing countries like England, France, and
. The direct labor cost, however, is a larger item in the total
of manufacture than in most stages of iron and steel pro-
, but this higher cost has not thus far proved a handicap to
ierican manufacturer. The most pressing tariff problem with
ce to dies, die blocks, and blanks is that of proper classifica-
Die blocks should be separated from dies and the latter divided
ng to character and perhaps principal uses.

General Information.

Tariff Act of 1913.

RAPH 110. * * * die blocks or blanks * * * made by the crucible,
or cementation process, either with or without alloys, and finished by roll-
mering, or otherwise * * *, 15 per centum ad valorem.
RAPH 613. * * * die blocks or blanks * * * made by the Bessemer,
Martin, open-hearth, or similar processes, not containing alloy, free.
RAPH 167. Articles or wares not specially provided for in this section;
if composed wholly or in chief value of iron, steel, lead, copper, brass,
ewter, zinc, aluminum, or other metal, but not plated with gold or silver,
ther partly or wholly manufactured, 20 per centum ad valorem.

DESCRIPTION.

Dies are so various that the term is only slightly informative. Some dies are made from the most highly advanced alloy steels and even rough diamonds and others are made from simple carbon steels. They vary greatly in form and uses. Generically the term "die" signifies block or cube. In modern usage, however, the term is employed to designate a great variety of forms. In a general way it may be said that there are four principal classes of dies, omitting the block and blank, which is simply a preliminary or crude stage in process of manufacture. These classes are as follows:

(1) *Drop forging and pressing dies.*—These dies are made in pairs, one attached to the hammer or press head of a forging or shaping machine and the other forming a lower die or anvil. These are comparatively simple forms, weighing from 200 to 3,000 pounds. There are metallurigcal and engineering difficulties in making these dies, as they have to resist heat and wear and are therefore often made of special alloy steels designed to stand heat treatment without undue strain, as well as form the metal operated upon into the shape desired. These dies are of growing importance as forged shapes are being largely substituted for castings and structural shapes. They are not usually embossed or engraved. Those used for cold pressing are made for forming thin and soft metal.

(2) *Wortle or draw plate.*—This plate is often called a wire-drawing die. Generally it is made of high-carbon steel or of rough diamond set in metal; the latter is used for the finer wires. A hole is pierced in the steel or diamond through which a wire with a tapered point is passed. The section of the hole is less than the section of the wire and the latter in being drawn through it is consequently reduced in size.

(3) *Embossing dies.*—These are used in presses consisting of two pieces of metal varying in size from 1 to 20 inches in diameter. They constitute a highly advanced form, the surface of which is engraved or embossed with the pattern to be formed. These patterns are made by highly skilled workers.

(4) *Lettering dies.*—These dies have letters or figures cut on them by skilled workers, and they may be in the form either of rolls or stamps.

Taps and dies are classed with small tools and are, therefore, not included in this survey. They are used for cutting threads.

Other classifications of dies may be made and dies which are outside of the classification above given may be designated. The above classification, however, covers the bulk of the dies considered in this survey. Mention may be made, however, of combination drawing dies which are used in double-action presses. A pair of such dies is composed of an upper die and lower die and a punch. They cut a blank which is drawn from between two flat surfaces over a smooth, round edge by the punch, the product being a smooth-edged shell of greater or less depth, and is obtained by one stroke of the press. These dies may be round, oval, square, or oblong, the oval being the most costly. Another die, or combination of dies, is the automatic die head and chasers and taps for use in machine and hand tools. These are used for threading pipes and bolts. Other dies are tube-drawing dies, wire-annealed dies, single and double, beveled, square,

, annealed, and dies and punches used in punching holes for rivets bolts in all kinds of metal.

USES

The uses of dies are many, but may be summed up as cutting or aping blanks of sheet or other metal, paper, and other articles. me dies are simply hammering and forging instruments. Others e employed to make impressions upon sheet and other metal. me are used for reproducing stamped or lettered articles.

DOMESTIC PRODUCTION.

There is no statistical material which can give any indication of e amount of dies, die blocks, etc., produced. It is known, how-er, that the manufacture of dies is an important branch of the iron nd steel industry.

Raw materials.—The raw material of dies consists for the most part f iron or steel. Other material, like rough diamonds, is also used n very limited quantities. The best grade of acid open-hearth alloy teel constitutes an important part of the material used, its raw form eing usually inverted mold-cast ingots of medium carbon tool steel. A fair amount of high-grade steel made by the crucible or electric rocess is also employed. Alloy steel, particularly tungsten and igh-speed steel, is used for certain operations. This is particularly rue in the case of wortle or wire-drawing dies.

Equipment.—The equipment used in the manufacture of dies consists of acid open-hearth, electric, or crucible furnaces, with specially esigned molds and pouring equipment adapted to bottom pouring. n addition steam hammers, steam hydraulic forging presses, heating urnaces, recording pyrometer control for annealing, quenching, and drawing; cranes, lathes, planers, and other machine tools and physcal, chemical, and metallurgical laboratories are employed.

Methods of production.—The methods of production are indicated y the equipment used. In addition to the operations of furnaces, eat treatment, hammering, shaping, etc., great care and intelligent upervision is necessary. The successful hardening without cracking f a die block with its large mass, sharp corners, and unequal depresions to produce a hard impression, faced with tough, dense packing, equires considerable care and is a task calling for most skillful maipulation. Much time and money are spent in the tool room to repare the desired forged impression—so much, in fact, that the itial cost of the block itself is insignificant in comparison with the ost involved in this preparation. It is also of importance that the ie-block user see that his hardening equipment is of the most modern ind and his methods and pyrometer control beyond question. The ighest grades of steel and the most careful methods of forging, heat eatment, and inspection must be used in the production of these nportant forgings, and all steps of manufacture must be taken accordg to the best principles of metallurgical control.

Labor cost is thus an important item in the expense of productn—more important than in the manufacture of most articles which ll as iron and steel.

Organization.—The manufacturers of dies are specialists. product is generally made locally and for use in special kind operation. The industrial unit may be large or small. A l fraction of the dies made in the United States are produced by tively small plants. About 800 manufacturers make steel-stam and steel-embossing dies for reproducing lettering designs, etc. manufactured products. There are probably a score or mor manufacturers who specialize on presses and dies, or include the their product. The amount of capital necessary to manufac dies is moderately large—a very small plant being capable of ducing only tool steel and die blocks. Many users of dies finish die they are to employ in their own plants. As deliveries are requ to be prompt, the special designs for the use for which the di made are prepared in the locality where the die itself is used. other words, the maker and user are often in close communicat In many lines of manufacture this necessary proximity constit a limitation on foreign imports.

Geographical distribution.—The industry is located for the m part in the northeastern section of the United States, particul in the region from the Atlantic to the Mississippi River, and nort of the Potomac and Ohio Rivers.

History of the industry.—Hand-made and hand-used dies are old commodity. The growth of the automobile business since opening of the present century has been an important factor in development of the manufacture of highly-specialized forms of d The development of cold-rolling and cold-hammering in the iron steel industry has also been an important factor in the growth of industry. Certain changes in industrial technique and in habit living have caused considerable specialization of articles which h resulted in a corresponding specialization in this branch of ma facture; thus corrugated and formed shapes stamped from sheets plates have been substituted for castings. The development of canning industry has increased the use of dies in the manufactur containers. The increasing cost of wood has resulted in a gre use of metal formed by dies in the shape of barrels, signs, and like. The manufacture of metal furniture is a new and grow industry in which dies are used.

Domestic production and consumption.—There are no avail statistics of the amounts or values of the dies, etc., produced consumed in the United States. Import and export statistical d are also lacking. It is known, however, that exports and imp are very small and hence domestic consumption is approxima equal to domestic production.

Domestic exports.—While domestic exports are small, some are sent out of the country. A manufacturer of dies and pre states that his company exported presses to Canada, England, France during the war, but that their customers made their dies. Some steel dies are exported to Sweden, Norway, Aust France, India, South America, and Spain. One manufactu reports that he exports to England about $10,000 worth of die he and chasers per year.

A manufacturer of tool steel states that, in his opinion, very li steel in the form of dies is exported from the United States. Th is, however, some trade with Canada in spite of the fact that Am

makers are at some disadvantage on account of the preferential ff rates in favor of English steels.

FOREIGN PRODUCTION.

Jo statistical data are available with reference to foreign produc- n. It may be said, however, that the steel-producing countries he world, like England, Germany, and France manufacture dies. in the case of many iron and steel products domestic manufac- ers state that European producers have lower costs than American ducers, but trustworthy evidence is lacking.

IMPORTS.

There are no available statistics with reference to imports. It is own, however, that imports are small. A manufacturer of presses d dies states that his concern has had no occasion to import mate- l. A manufacturer of dies who exports some of his product to eden, Norway, Austria, and other countries reported that before e war he did not meet with any active competition in the domestic arket from foreign producers. Another manufacturer states that does not know of any competition with reference to die blocks for op-forging work. In the form of bars for dies to be used for anking or for forming jewelry or silverware there is now some reign competition and before the war, there was a considerable nount of foreign rivalry. This competition came chiefly from igland, to some extent from Sweden, and to a more limited extent, m France. A manufacturer of embossing dies states that to the st of his knowledge all such material used in this country is "made the U. S. A."

PRICES.

Dies, die blocks, etc., are highly specialized products. Hence ices are not quoted in trade papers but are quoted by manufac- rers on application, the designs and specifications being given. ring the war prices showed a marked increase. One manufac- rer states that prices in his lines in 1920 were 225 per cent above e 1912 levels. Another producer declared that prices advanced in lines about 20 per cent since 1915.

During the war, English carbon tool steel of the class used in the anufacture of dies was quoted higher than the corresponding nerican prices. In the fall of 1920 the prices asked by English el manufacturers for most steel suitable for the manufacture of s were considerably higher than American prices.

TARIFF HISTORY.

The tariff act of 1894 named specific duties on die blocks and anks, varying from 0.3 to 4.7 cents per pound, according to the lue of the steel. The same duties were imposed by the act of 97. The act of 1909 named a duty of 7/40 cents per pound on die cks or blanks valued at three-fourths cent per pound or less. ties on higher-priced steel were graduated according to value up 7 cents per pound when the steel was valued at over 32 cents

and not over 40 cents per pound, and an ad valorem duty of 20 per cent when the steel was valued above 40 cents per pound. In the act of 1913 a duty of 15 per cent ad valorem was placed on die blocks or blanks if made by the crucible, electric, or cementation processes with or without alloys. Die blocks or blanks made by the Bessemer or open-hearth processes and not containing alloys were placed on the free list.

Foreign tariffs do not mention dies, die blocks, and blanks.

COMPETITIVE CONDITIONS.

Very little foreign competition is experienced in most lines of this industry. The necessity of close proximity between producer and consumer in many lines preclude active foreign competition. As already noted, however, there is some importation of bars for dies used for blanking or for forming jewelry or silverware and here the competition was considerable before the war and is appreciable at the present time (1921). The importation of English material is due largely to the reputation of English goods rather than to low prices, the English product having been marketed in this country long before similar products were manufactured in the United States. Most of the material used in the production of dies is as cheap in the United States as in any other part of the world. Labor cost is an appreciable item and the rates of wages in this country are higher than in England, Sweden, France, and other producing countries. Up to the present time, however, the American producer has been able to hold his own in competition with the foreign manufacturer.

TARIFF CONSIDERATIONS.

Aside from bars or dies used for blanking or for forming jewelry, silverware, and the like, there is apparently little foreign competition and it is doubtful whether even in this line the competition is formidable. In most other lines the American manufacturer is in a position to hold the domestic market.

The outstanding fact in tariff considerations is the lack of an adequate classification. Dies, die blocks, etc., being highly specialized articles, some classification is necessary according to character and use. The four classifications given above under the head of "Description" could be employed. The products of this industry are too various and the conditions of production so different that a tariff rate simply applying to all the articles coming under the designation of "Dies" would appear illogical.

Rates of duty.

...ct of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
83....	177	* * * die blocks or blanks; * * * all of the above classes of steel not otherwise specially provided for in this act, valued at 4 cents a pound or less.	45 per cent ad valorem.
		Above 4 cents a pound and not above 7 cents per pound.....	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	2½ cents per pound.
		Valued at above 10 cents per pound.....	3½ per pound.
90....	146	* * * die blocks or blanks; * * * all of the above valued at 1 cent per pound or less.	0.4 cent per pound.
		Valued above 1 cent and not above 1.4 cents per pound.....	0.5 cent per pound.
		Valued above 1.4 cents and not above 1.8 cents per pound....	0.8 cent per pound.
		Valued above 1.8 cents and not above 2.2 cents per pound.....	0.9 cent per pound.
		Valued above 2.2 cents and not above 3 cents per pound.....	1.2 cents per pound.
		Valued above 3 cents and not above 4 cents per pound.....	1.6 cents per pound.
		Valued above 4 cents and not above 7 cents per pound.....	2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	2.8 cents per pound.
		Valued above 10 cents and not above 13 cents per pound.....	3½ cents per pound.
		Valued above 13 cents and not above 16 cents per pound.....	4.2 cents per pound.
		Valued above 16 cents per pound.....	7 cents per pound.
94....	122	* * * die blocks or blanks; * * * all of the above valued at 1 cent per pound or less.....	0.3 cent per pound.
		Valued above 1 cent and not above 1.4 cents per pound.....	0.4 cent per pound.
		Valued above 1.4 cents and not above 1.8 cents per pound....	0.6 cent per pound.
		Valued above 1.8 cents and not above 2.2 cents per pound...	0.7 cent per pound.
		Valued above 2.2 cents and not above 3 cents per pound.....	0.9 cent per pound.
		Valued above 3 cents per pound and not above 4 cents per pound.....	1.2 cents per pound.
		Valued above 4 cents and not above 7 cents per pound.....	1.3 cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	1.9 cents per pound.
		Valued above 10 cents and not above 13 cents per pound.....	2.4 cents per pound.
		Valued above 13 cents and not above 16 cents per pound.....	2.8 cents per pound.
		Valued above 16 cents per pound.....	4.7 cents per pound.
97....	135	* * * die blocks or blanks; * * * all of the above valued at 1 cent per pound or less.....	0.3 cent per pound.
		Valued above 1 cent and not above 1.4 cents per pound.....	0.4 cent per pound.
		Valued above 1.4 cents and not above 1.8 cents per pound....	0.6 cent per pound.
		Valued above 1.8 cents and not above 2.2 cents per pound...	0.7 cent per pound.
7....	135	Valued above 2.2 cents and not above 3 cents per pound.....	0.9 cent per pound.
		Valued above 3 cents and not above 4 cents per pound.....	1.2 cents per pound.
		Valued above 4 cents and not above 7 cents per pound.....	1.3 cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	2 cents per pound.
		Valued above 10 cents and not above 13 cents per pound.....	2.4 cents per pound.
		Valued above 13 cents and not above 16 cents per pound.....	2.8 cents per pound.
		Valued above 16 cents per pound.....	4.7 cents per pound.
)....	131	* * * die blocks or blanks; * * * all of the above valued at three-fourths of 1 cent per pound or less.	7.40 cents per pound.
		Valued above three-fourths of 1 cent and not above 1.3 cents per pound.	0.3 per pound.
		Valued above 1.3 cents and not above 1.8 cents per pound...	0.5 cent per pound.
		Valued above 1.8 cents and not above 2.2 cents per pound...	0.6 cent per pound.
		Valued above 2.2 cents and not above 3 cents per pound.....	0.8 cent per pound.
		Valued above 3 cents and not above 4 cents per pound.....	1.1 cents per pound.
		Valued at 4 cents and not above 7 cents per pound.....	1.2 cents per pound.
		Valued above 7 cents and not above 10 cents per pound.....	1.9 cents per pound.
		Valued above 10 cents and not above 13 cents per pound.....	2.3 cents per pound.
		Valued above 13 cents and not above 16 cents per pound.....	2.7 cents per pound.
		Valued above 16 cents and not above 24 cents per pound.....	4.6 cents per pound.
		Valued above 24 cents and not above 32 cents per pound.....	6 cents per pound.
		Valued above 32 cents and not above 40 cents per pound.....	7 cents per pound.
		Valued above 40 cents per pound.....	20 per cent ad valorem.
....	110	* * * die blocks or blanks; * * * all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, and all steels by whatever process made, containing alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	15 per cent ad valorem.
....	613	* * * die blocks or blanks, * * * if made by the Bessemer, Siemens-Martin, open hearth or similar processes, not containing alloy, such as nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys.	Free.

UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 111, 112, 113, 114, 115, 116, AND 117 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

WIRE

WIRE RODS AND MANUFACTURES OF WIRE

Paragraph 110:
Wire Rods

Paragraph 111:
Steel Wool. (See paragraph 75)

Paragraph 112:
Steel Grit, Shot, and Sand. (See paragraph 75)

Paragraph 113:
Wire Rods

Paragraph 114:
Insulated Wires and Cables
Wire Rope and Strand
Iron and Steel Round Wire
All Other Wire
Corset Clasps, Corset Steels, and Flat Wire
Woven Wire Fencing
Wire Heddles and Healds
Manufactures of Wire n. s. p. f.

Paragraphs 115, 116, and 117:
Administrative. (To be discussed separately)

Paragraph 124:
Card Clothing

Paragraph 140:
Wood Screws

Paragraph 141:
Umbrella Hardware

Paragraph 158:
Pins

Paragraph 554:
Wire Rods
Wire Nails and Spikes
Cut Nails and Spikes
Forged Spikes
Horseshoe Nails
Tacks, Brads, and Staples

Paragraph 645:
Iron and Steel Round Wire
Barbed Wire
Woven Wire Fencing

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles and commodities provided for in the tariff act of October 3, 1913, and others not specifically provided for. It is arranged in the numerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one pamphlet. In doing this, industrial relationship of the articles has been followed when possible. In those instances where a paragraph has been treated under a preceding paragraph of the tariff act, reference is made to this fact at the point where the paragraph appears in numerical order. Where one grade of an article is dutiable and another grade of the same article is on the free list, the article is discussed under the dutiable paragraph, which appears first in numerical order in the tariff act. In certain instances articles of close industrial relationship and which occur in separate paragraphs of the tariff act have been combined under one paragraph for convenience of discussion. Reference is made to this fact at the point where the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," which contains:

1. An introductory chapter discussing the scope of the series and the general method of treatment.

2. An alphabetical index of the articles provided for in the tariff act of 1913, showing the paragraph of the act in which the article is provided for and, if discussed under a different paragraph, the number of such paragraph.

3. A list of the pamphlets in the series, showing the paragraphs and articles included in each pamphlet.

Thus by use of this "Introduction and Index," the exact location of the discussion relating to a given article or commodity can be ascertained.

In the preparation of this report the Tariff Commission had the services of H. J. Bierman, Walter Graham, and Louis A. Rufener, of the Metals Division of the Commission's staff, and of others.

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IRON AND STEEL WIRE RODS.

SUMMARY.

TARIFF CLASSIFICATION.

Iron and steel wire rods are provided for in paragraphs 110, 113, and 554 of the act of 1913. The first lays a duty of 15 per cent ad valorem on rods made by the more costly processes of steel making—crucible, electric, or cementation—or alloyed with certain other metals; the second, a duty of 10 per cent on other wire rods, including those cold rolled, cold drawn, hammered or polished, except horseshoe-nail rods, admitted free under paragraph 554. Under this act to June 30, 1917, 4½ per cent of the value of the rods imported entered under the 15 per cent duty, 80 at 10 per cent, and 15½ free. The latter class—horseshoe-nail rods—were imported only in 1914 and 1915, when they formed 22½ per cent of the value of the imports.

DOMESTIC PRODUCTION AND CONSUMPTION.

In 1914, 2,378,000 long tons of iron and steel wire rods were produced, valued at $61,578,000. Imports were 15,000 tons, exports, 56,500. The war has resulted in increase of production and exports and decrease of imports. The United States thus produces in excess of domestic consumption. The advantage of the United States in the production of rods lies in the use of the automatic and semi-automatic machinery, applied to produce rods of standard quality on a large scale.

The principal producers in 1914 were Pennsylvania, Ohio, and Illinois, States in which there are a large number of steel works and rolling mills.

SIGNIFICANCE OF THE IMPORTS.

Imports, which have come largely from Sweden, have consisted of rods of high quality for special uses. The manufacture of horseshoe nails and the making of wire for wire rope are important among such uses. These articles require a purity of material—i. e., freedom from phosphorus and sulphur—which the Swedish rod makers could attain because of the use of very pure ores in the making of their steel and of methods which resulted in the introduction of few impurities. Production, in addition, is on a small scale, and great care can be given to these relatively small tonnages.

The American manufacturer is able to produce rods of a quality equal to the imported, and two of the wire-rope manufacturers who have substituted domestic for foreign rods after the imports were cut off because of war conditions express satisfaction with the results. With the advantage of superior quality gone, further imports of

foreign goods depend upon the efficiency of foreign industry in comparison with American in the production of these grades of rods. This can be determined only after postwar readjustments are completed.

Iron and steel wire rods—Summary table.

[Tons of 2,240 pounds.]

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.		Value (imports for consumption).[2]	Amount of duty.[2]	Value per pound.	Actual or equivalent ad valorem rate.
				Imports.	Exports.				
	Tons.	*Tons.*	*Tons.*		*Per cent.*				*Per cent.*
1910	2,241,830	16,307	24,942	0.72	1.11	$809,373	$113,319	$0.022	14.00
1911	2,450,453	18,721	17,753	.76	.72	894,837	120,315	.021	14.12
1912	2,653,553	14,112	47,936	.53	1.81	681,721	94,843	.022	13.91
1913	2,464,807	17,352	74,823	.70	3.40	837,326	117,008	.022	13.97
1914	2,377,691	14,389	56,493	.62	2.38	743,957	68,393	.022	9.19
1915	3,045,907	8,113	98,441	.26	3.18	403,840	28,392	.022	7.01
1916	3,518,746	4,719	171,529	.13	4.88	398,860	41,006	.05	10.28
1917	3,137,138	2,039	147,226	.07	4.70	295,690	30,152	.064	10.19
1918	2,562,340	6,781	186,583	.26	7.28	697,156	70,026	.046	10.04
1919	2,538,176	2,012	141,889	.08	5.71	158,650	16,291	.035	10.27
1920	.....	1,557	111,827	.....	.....	205,826	21,349	.059	10.37

[1] Calendar years. [2] Fiscal years ending June 30. [3] Census figures.

General Information.

TARIFF PARAGRAPHS, ACT OF 1913.

110. * * * rolled wire rods in coils or bars not smaller than twenty one-hundredths of 1 inch in diameter, and steel not specially provided for in this section, all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, and all steels by whatever process made, containing alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, 15 per cent ad valorem.

113. Rivet, screw, fence, nail, and other iron or steel wire rods, whether round, oval, or square, or in any other shape, and flat rods up to 6 inches in width ready to be drawn or rolled into wire or strips, all the foregoing in coils or otherwise, including wire rods and iron or steel bars, cold rolled, cold drawn, cold hammered, or polished in any way in addition to the ordinary process of hot rolling or hammering, not specially provided for in this section, 10 per cent ad valorem: *Provided*, That all round iron or steel rods smaller than twenty one-hundredths of 1 inch in diameter shall be classed and dutiable as wire.

554. * * * horseshoe-nail rods, * * *. Free.

DESCRIPTION AND KINDS.

Description.—Wire rods differ from wire in being produced by hot rolling, a process which leaves the rod coated with a black oxide of iron ("scale"). This process can not be used to produce rods as small nor as uniform a cross section as can be produced by the drawing process. The ordinary commercial steel wire rod is circular in

ross section, of a diameter of 0.205 of an inch (No. 5 wire gauge). Other shapes and sizes are also rolled. The act of 1913 specifies "round, oval, or square, or * * * any other shape, and flat rods up to 6 inches in width ready to be drawn or rolled into wire or strips."

After rolling, the rods are reeled into coils of from 150 to 300 pounds in weight.

Kinds.—Wire rods may be divided into kinds according (1) to the uses to which they may be put, (2) the physical characteristics of the material which they contain, (3) the process by which the steel from which they are made is produced, (4) the finish imparted to them.

1. *Use.*—Their most common use, as is indicated by their name, is for drawing wire, whether or not this is to be used directly or be manufactured into nails, woven-wire fencing, or other articles. Some other articles, however, are made directly from them, without drawing, as small rivets, screws, and bolts. The tariff of 1913 specifies "rivet, screw, fence, nail, and other wire rods," also horseshoe-nail rods. Recently wire rods have been used without drawing for the construction of antisubmarine nets.

2. *Material.*—Wire rods may be classified according as they are of iron or steel, and steel rods according to their carbon content, or according to alloys contained in them. Iron rods form but a small portion of the output. Only a small portion of the rods made are alloyed. One important alloy used is chromium, rods alloyed with it being used in the manufacture of wire from which the small balls used in ball bearings are made.

3. *Process.*—The act of 1913 distinguished between rods made of steel produced by the "crucible, electric, or cementation processes," or containing alloys, and of that produced by other processes—the Bessemer, open-hearth, Siemens-Martin, or the like. This distinction according to processes is the general distinction made in paragraph 10, which divides certain articles, not containing alloys, made of steel produced by the "Bessemer, Siemens-Martin, open-hearth, or similar processes" from those made by "the crucible, electric, or cementation process," or containing alloys, and levying a duty of 8 per cent on the first and 15 on the second. It is a fact, affirmed by the chemist of the port of New York, that this is one of the steel clauses of the schedule which is ambiguous and difficult to administer in its present form. In certain cases this difficulty is such that an accurate interpretation is impossible, as it is often impossible at the present day to identify open-hearth and crucible steel, even by microscopic or laboratory analysis of a most expert nature. Formerly this could be done, as open-hearth carried lower carbon, but the two steels are now frequently impossible to distinguish by analysis or structure, and this schedule can therefore be administered only on makers' affidavits.

The cementation process of steel making is one of the older processes still used to some extent, especially in England. It consists in heating iron bars at a red heat with charcoal in cast-iron pots. The furnace reaches its full temperature in 3 to 4 days, is maintained at it from 7 to 11 days, the longer for the production of steels higher in carbon. The cooling requires 4 to 6 days. The iron absorbs carbon from the charcoal, thus becoming steel. The product coming from

the furnace is known as blister bar or cemented steel. Shear steel is produced by piling and welding these bars.

Crucible steel was first made by melting down the blister bar in crucibles—pots made of graphite or clay. The process now used in America is more direct. Charcoal or puddled iron, or a mixture of the two, are packed in the crucibles, and brick dust, lime, or black oxide of manganese are added to produce a fluid slag. Bessemer or open-hearth steel may also be used, but the product obtained is inferior to that obtained with wrought iron, though superior to the steels used. The process, as ordinarily practiced, is not a refining but simply a melting operation.

The crucible is a relatively small-scale process, producing, at a higher cost, steel superior to Bessemer or open-hearth.

The electric process is one in which the heat used for the melting and purification of the iron is produced by an electric current. The heat may be generated (1) by an induction current set up in the metal, (2) by the resistance the metal offers to a current passing through it, (3) by the resistance offered to the current by some other conducting material placed between the electrodes, or (4) by an arc between the electrodes or the electrodes and the surface of the metal. This process is akin to the open-hearth and Bessemer processes in that the iron is purified as well as melted, rather than simply melted and carburized, as in the crucible process. It is capable of producing, however, a grade of steel superior in quality to the ordinary open-hearth steel and on a larger scale than the crucible process. The furnaces operating in the United States in 1914 ranged in charge capacity from less than 1 ton to 15 tons. A heat takes less time than for an open-hearth furnace, so that a much smaller charge capacity will produce the same daily output.

The advantages of the electric process are (1) the higher temperature available, making (2) greater purification possible, (3) more complete exclusion of air and gases (except that effected in the crucible process), and (4) the introduction of fewer impurities through the fuel used. The cost is higher than that of the Bessemer or open-hearth processes, and the electric furnace is thus available only for making the finer grades of steel or for purifying open-hearth steel.

The Bessemer, Siemens-Martin, and open-hearth processes are those used in the large-scale production of steel. The first of these consists in blowing air through molten pig iron contained in a pear-shaped vessel called a converter. The impurities are thus oxidized and removed. The converter has a capacity of from 8 to 20 tons per heat, and a heat takes, in the United States, from 8 to 15 minutes. The output of a pair of converters is from 40,000 to 65,000 tons per month.

In the open-hearth process the oxidization and removal of the impurities is accomplished by heat generated over the surface of a hearth containing the metal by the combustion of air and gas. In the original (Siemens) process, pig iron was melted alone and oxidized with iron ore. In the Siemens-Martin process, which is simply a modification of this, scrap is added to the molten pig iron without ore, and there is little oxidization. These names have, however, lost their significance, and are used interchangeably, the two processes being distinguished as the "pig and ore" and "pig and scrap" processes.

The hearth on which the metal lies is relatively shallow. It is closed and roofed over, and air and gas are blown in over the metal, urning above the bath. The distinctive thing in the open-hearth rnace is the preheating of the gas and air prior to their combustion the furnace. This is accomplished by feeding them to the furnace rough flues previously heated by the passage of the hot gases left ter combustion. The two sets of flues contain "checkerwork"; e., bricks set on edge and arranged so as to form many small passages rough which the gas or the air passes. After combustion has taken lace above the bath, the hot residue gases are drawn off through a rresponding checkerwork at the other side of the furnace. After is has reached a sufficient temperature, the direction of the blast reversed, and the gas and air are heated as they pass through the ot checkerwork. The hot residual gases now heat the checkerwork the other end. When the temperature of the checkerwork rough which the air and gas are entering has become low, the blast again reversed. When producers gas is used, both it and the air e so preheated; sometimes only the air is so treated.

Open-hearth furnaces usually have a capacity of from 40 to 70 ns; for special purposes they are made as large as 200 tons or over. furnace will make 12 to 22 heats a week, depending on the size—s for the larger tonnage than the smaller.

The relative importance of these different processes may be judged om the census reports. In 1914 there were 140 open-hearth furnaces the United States, of a daily capacity of 93,650 tons; 115 convert-s, of a daily capacity of 53,016 tons; 241 crucible furnaces, of 886 ns daily capacity, and 15 electric furnaces, of 438 tons daily ca-city. Recent development of the electric furnace has been rapid.

4. *Finish.*—The act of 1913 included under the same rate with rivet, screw, fence, nail, and other wire rods," rods and bars which ve been cold-rolled, cold-drawn, cold-hammered, and polished. hese cold treatments are given rods to produce a more accurately ooth exterior and a harder surface. Bars may be cold-drawn for e same purpose. The process of cold drawing is used to convert ire rods into wire. (See Survey on Round Iron and Steel Wire, lain and Galvanized.)

DOMESTIC PRODUCTION.

Quantity.—The census gives the production of iron and steel wire ds in 1914 as 2,377,691 long tons, valued at $61,578,145. During is year prices were low, and production relatively small. Accord-g to the statistics of the Iron and Steel Institute there was a naller production in 1914 than in any year subsequent to 1910. hese figures show a production in 1915 (3,095,907 tons) 27 per nt greater than in 1914 (2,431,714 tons), and in 1916 (3,518,746 ns) 12 per cent greater than in 1915.[1]

The production of iron wire rods are given separately by the Iron d Steel Institute. The average yearly production, 1910–1917, was 142 tons—about 0.05 per cent of the total production.

After the entrance of the United States into the war and the sub-quent control of the Government over steel production, there was decrease in the production of wire to allow diversion of steel to

[1] Annual Statistical Report, 1916, p. 42.

the production of plates and munitions. (See Survey on Round Iron and Steel Wire.) Decreased use of rods for the manufacture of wire at home and large exports have characterized the two years ended June 30, 1918.

The steady growth prior to the war from less than 1,000,000 long tons in 1900 to 3,137,000 in 1917 has accompanied a steady increase in the production of wire.

Methods and processes.—There are two types of rolling mills used in the production of wire rods—the continuous mill and the looping mill. In the continuous mill the hot billet is introduced at one end and passes through a succession of horizontal rolls, which reduce its cross section. In order to prevent the rod from becoming flattened, it is run through a guide between each set of rolls, which turns it through 90°. The successive rolls run at increasing speeds to allow for the lengthening of the rod, which takes place as it becomes smaller. At the end of the rolls the rod enters a pipe, through which it is fed onto the reel. This consists of a plate revolving in a horizontal plane at a peripheral speed equal to that at which the rod travels. Upon it are fixed two concentric rows of pins, between which the rod is fed from above through the pipe. The movement of the reel and the rod coil the latter between the pins. In another form of reel the plate is stationary, and the pipe in which the rod is carried revolves, laying the rod between the pins of the reel.

The second type of mill is the looping mill. The reduction of the billet is made on a mill consisting of three rolls, set one above the other. It first passes between the center and bottom rolls, and is returned between the center and top rolls. After a certain reduction has been made in the first set of rolls it goes to another similar set, run at a higher speed. When it has been sufficiently reduced, the rod is looped between the rolls, that is, the forward end is inserted in the return pass between the center and top rolls, while part of the rod is still passing between the center and bottom rolls. The looping is done either by a laborer with a pair of tongs or an automatic device. This device consists of a semicircular trough in a vertical plane, which reverses the direction of the rod and feeds it between the center and the top rolls. It has not proven satisfactory when the rods passing through the guides are not square, as is the case after every other pass. On these alternate passes hand labor may be used, or the mill so arranged that at this stage the rod goes to another set of rolls. Since the lengthening of the rod as it is reduced in cross section is not compensated for by differences in the speed at which the rolls are run, loops, constantly increasing in length, occur between the passes. These are taken care of on sloping floors. Of these two types of mills, the continuous mill is automatic, and the best forms of looping mills semiautomatic. The latter requires the greater number of laborers, and the "catcher" who turns the rod from one pass to the next is a skilled laborer.

The rolling of the rod is carried to a point where it is commercially more advantageous to draw the wire than to roll it. The No. 5 wire rod (0.207 inch in diameter) stands at this point, and has become the standard rod.

Material and equipment.—The raw material for wire rods is the billet. The billet is a piece of steel which has been rolled into a square piece, from 1½ to 6 inches across, and cut into lengths. The wire-rod mill usually takes a billet 4 inches square.

e equipment of the industry consists of the machines described e, and heating furnaces for the treatment of the billets. This ment requires a large outlay of capital. The billet may be ased or made in the same works in which the rods are rolled. me foreign billets are used in the rolling of rods to be converted wire for special uses, but such material forms a very small ion of the raw material. Such use is to be explained on the basis as the importation of wire rods—the greater purity of the rial.

ganization and capitalization.—The rolling of wire rods is merely ntermediate step in the production of the wire from the billet, product being used almost entirely for the production of wire. rolling of wire rods is therefore carried on usually in conjunc- with the production of the cruder forms of steel or with that of

ire rods are an important product of the steel works and rolling . In 1914 the value of the products manufactured by such lishments was $919,000,000, of which wire rods formed 00,000, or 6.7 per cent. This industry is the first in the United s in the number of large plants. In 1914 plants producing $1,000,000 to $10,000,000 worth of products produced 52.2 ent of the total value and plants producing over $10,000,000 per cent.

the 427 steel works and rolling mills in 1914, only 20 were not rations. These establishments produced but 0.5 per cent of alue of the products.

calities of production.—In 1914 Pennsylvania led in the produc- of wire rods. Ohio, Illinois, Indiana, West Virginia, Massachu- , New Jersey, and New York were also important producing s.

general, these are the States in which the steel works and rolling are situated. Their location is primarily explained by nearness w material—especially coal.

mestic consumption.—The consumption of wire rods is as follows:[1]

Year.	Tons.	Per cent.	Year.	Tons.	Per cent.
.....	2,239,335	99.89	1915.....	2,936,210	94.84
.....	2,443,295	99.71	1916.....	3,364,592	95.62
.....	2,603,644	98.12	1917.....	2,936,257	94.23
.....	2,419,268	98.15	1918.....	2,421,544	94.50
.....	2,376,812	97.74	1919.....	2,420,808	95.36

e domestic production is thus larger than domestic needs, and xports have been growing.

ports.—Exports during the three fiscal years 1910–1912 averaged 0 tons per year; during the next two years 65,658. In 1915 were 98,441, and during the next year 171,529 tons. For the following years they averaged 166,904 tons.

1914 exports were equivalent to 2.4 per cent of the census e for domestic production; in 1919, to 5.7 per cent of the produc- as given by the American Iron and Steel Institute.

[1] American Iron and Steel Institute, Annual Statistical Report, 1919, p. 43.

In 1914, 99.7 per cent of the export went to Canada. Europe and Asia took a large portion of the increase of the following years. In 1919 exports to Europe were 51,930 tons, 44 per cent of the total export, as against an average of 292 tons for the two years before the war. Exports to Asia were 34,243 tons.

Exportation to Europe has gone chiefly to Great Britain, France, Italy, Spain, and Norway. It has been accompanied by increases in the amount sent to South America, Japan, and China.

History.[1] -Prior to 1860 wire rods were rolled on small, two-high bar mills, the rod being handled back over the rolls after each pass. The rolling started with a 1¼ billet, weighing about 10 pounds, from which a rod 14 feet long was produced with a guage, at the smallest, of ¼ an inch. A 5-ton daily output was considered satisfactory. The first improvement was the introduction of the three-high mill, formed of three instead of two rollers, and thus able to work the metal on the return pass. This process made it possible to roll a smaller rod (¼ inch in diameter) and longer lengths. When the rod became limber enough it was found possible to bend it and enter it in the third pass while part of it was still in the rolls; in fact, three or more passes might be in the rolls at the same time. To make room for the men who had to catch and return the rods, more than one stand of rolls was used, the stands being coupled together, end to end, and all running at the same speed. This is the so-called Belgian mill, in use in Europe in 1867. It was developed in the United States by William Garrett, then employed by the Cleveland rolling mill. To this work is due the present use of the 4-inch billet as the raw material of wire-rod rolling. Formerly the smallest available bloom was 6 inches square, and the rod mills took a much smaller billet. Garrett got the blooming mill to roll down to 4 inches square, and the wire mill to accept this as its raw material. He developed the repeater, which looped the rods between the passes on one side, thus eliminating a part of the labor which had kept the looping mill a costly process.

The development of continuous rod rolling began with George Bedson, of Manchester, England, who placed the stands of rolls for the reduction of the rods tandem, the rod moving through the mill in a short, straight line, and being continually reduced, the growing length being provided for in the speed at which the successive rolls were run. As the rolled section is reduced only in a direction at right angles to the axis of the rolls, Bedson set each alternate stand of rolls vertically. This model had its disadvantages in that the vertically set pair of rolls wore out their lower bearings very fast because of dropping of scale and difficulty of lubrication. The wrought iron then used behaved erratically in the rolls. In 1870 low-carbon Bessemer steel was introduced, which gave a sound and uniform billet, permitting longer rods to be rolled.

In 1869 the Washburn & Moen Manufacturing Co. purchased a Bedson mill. Charles H. Morgan was in charge of the operation of this mill. On the model of the Bedson, he designed and built a new continuous mill, from which the continuous mill (Morgan) of to-day has developed. The main change was the abandonment of the alternating horizontal and vertical rollers of the Bedson mill, and the substitution of guides to twist the rod between passes, so that the

[1] Kenneth B. Lewis, "Wire and wire rods." Chapter in the A. B. C. of Iron and Steel, 1917, p. 1581.

es of horizontal rollers might effect a reduction on all sides of the
He also improved the reel upon which the rod was wound after
ad been rolled.

FOREIGN PRODUCTION.

roduction of wire rods is carried on extensively in the principal
and steel producing countries in Europe—Germany, Great
ain, and France.

IMPORTS.

uantity.—In the last five fiscal years unaffected by the war
10–1914) the average yearly import of wire rods was 16,266 tons,
ued at $793,443. During the next three years, 1915–1917,
orts decreased steadily, reaching 2,069 tons in 1917. During
9 they were 2,012 tons.

rincipal contributing countries.—The principal exporters of wire
s to the United States are Sweden and Great Britain. For the
five fiscal years unaffected by the war, 78.4 per cent of the
orts came from Sweden, 19.5 per cent from Great Britain. For
four following years these percentages are 58.4 and 8.8. In
7 Canada sent an import equal to Great Britain.

lasses and varieties.—Of the total importation under the act of
3 to June 30, 1917, of 26,785 tons of wire rods, 18,596 tons, or
3 per cent, were made up of rivet, screw, fence, etc.; 6,506 tons,
4.29 per cent, of horseshoe-nail rods; 877 tons, or 3.27 per cent,
ods made by the crucible, electric, or cementation process or
taining alloys, and 806, or 3.01 per cent of rods and bars which
been cold-rolled, cold-hammered, cold-drawn, or polished. The
orts of horseshoe-nail rods were confined to the years 1914 and
5. The quantity of rods imported which were made by the
ible, electric, or cementation process, or contained alloys, thus
ned but a small percentage of the imports—approximately 3¼
cent of the amount and 4⅔ per cent of the value. The following
e presents the statistics of imports and revenue under the act
913:

Imports and revenue under the act of 1913, Oct. 4, 1913, to June 30, 1917.

Kind.	Rate.	Quantity.		Value.		Revenue.		Ad valorem rate.
		Tons.	*Per ct.*		*Per ct.*		*Per ct.*	*Per ct.*
, fence screw, etc..	10 per cent..	18,596	69.43	$1,285,248	76.28	$128,524.80	86.88	10.00
shoe[1].....	Free.....	6,506	24.29	258,094	15.32	.....	.....	.....
by crucible, etc., esses or alloyed...	15 per cent..	877	3.27	75,246	4.47	12,787.50	8.64	15.00
tain finishes.....	10 per cent..	806	3.01	66,205	3.93	6,620.50	4.48	10.00
Total.....	Various ad valorem.	26,785	100.00	1,684,793	100.00	147,932.80	100.00	8.78

[1] Imports only during the fiscal years 1914 and 1915.

Destination in the United States.—Importations of dutiable wire rods are entered principally through the customs districts of New York, Massachusetts, and Philadelphia. Ninety-eight per cent were so imported in the years 1912–1914, and 97 per cent in the three years following, 1915–1917.

Character.—The imports of wire rods have been continuous, and although very markedly decreased by the war, have not been cut off. Imports in the fiscal year 1918 are larger than those of the two preceding years.

The reason for these imports is the purity of the iron or steel in the rods—especially the absence of sulphur—which makes them better fitted for manufacture into certain articles, such as horseshoe nails, wire rope, springs, umbrella ribs, and clock parts. This greater purity, however, is not a quality setting the imported rods into a distinct class, for it is possible of attainment on the part of the American manufacturers. The imported material is, to this extent, competitive with domestic industry.

Revenue.—The average yearly revenue collected on wire rods during the four fiscal years 1910–1913 was $113,000, on an average annual import of $806,000. The ad valorem rate equivalent to the specific duties charged was thus approximately 14 per cent.

Under the act of 1913, October 4, 1913, to June 30, 1917, duties to the amount of $147,932.80 were collected on imports of $1,684,793, at an average ad valorem rate of 8.8 per cent. Average yearly imports were thus approximately $480,000, revenue $42,000.

Imports to the amount of $1,351,453 were dutiable at 10 per cent, to the amount of $258,094 were admitted free as horseshoe-nail rods (none after June 30, 1915), and to the amount of $75,246 were dutiable at 15 per cent as made by the crucible, electric, or cementation process, or containing alloys. The revenue collected at 10 per cent was $135,145.30, and that at 15 per cent was only $12,787.50. This last figure forms 8.64 per cent of the total duties collected. At a rate of 10 per cent the amount of duty collected on these two classes of rods would have been $5,262.90 less on the same imports. The flat duty on these two classes of rods necessary to produce the duty actually collected on the same imports is 10.3 per cent.

The distinction made between rods produced by the crucible, electric, or cementation process, and the imposition of a higher rate on the latter class, is not, therefore, of importance in regard to the amount of revenue collected. The free admission of horseshoe-nail rods, which formed 28.3 per cent of the importation of rods in 1915 and 1916, resulted in a decreased revenue. Horseshoe-nail rods were so classified and put on the free list in the act of 1913, because horseshoe nails had been put there. (See Survey on Horsehoe Nails.)

Both the acts of 1909 and 1913 made reductions in the rate on wire rods. The latter was not in effect long enough before the war to show what its effects would have been on revenue under normal conditions. The imports of rods remained approximately the same, 1900–1914, despite these changes in rates. Such changes, therefore, have resulted in decreased revenue.

The revenue arising from the duty on wire rods, although not large in itself, is thus one which has been regular and dependable, for the amount imported remain fairly constant (previous to the war) and seems not to have been affected by changes or rate. Regarded as a

s on the total consumption of rods, it is small—a yearly average of 13,000 for the fiscal years 1910–1913, as against a consumption of er $60,500,000 in the calendar year 1914.[1]

PRICES.

Domestic.—For 1910 the average price of steel-wire rods per gross n at Pittsburgh was $30.37. It fell to $25.62 in 1914. Increase er this price began in September, 1915, when the monthly average ice was $29.40 per ton. From that date there was a steady increase til a price of $96.25 was reached in July, 1917. A short decline llowed until November, 1917, when the Government established a ice of $57 per ton.

Foreign.—The British fixed price was £21 10s. ($104.63).

TARIFF HISTORY.

Iron and steel rods fall under paragraphs 110, 113, and 554 of e act of 1913. The last of these provides for the admission of rseshoe-nail rods free. Under paragraph 110 a duty of 15 per nt is levied on rods made by the crucible, electric, or cementation rocess, or containing alloys. Paragraph 113 levies a duty of 10 r cent on "rivet, screw, fence, nail, and other iron or steel wire ds, including wire rods and iron or steel bars cold rolled, cold rawn, cold hammered, or polished in any way." Wire rods smaller an 0.20 inch in diameter are made dutiable as wire.

Iron and steel wire rods have been specified in the tariff acts nce 1890. The tariff acts prior to that of 1913 classified all round on and steel wire rods smaller than No. 6 (0.16202 inch in diameter) ire gauge as wire, and made them dutiable as such. Duties efore the act of 1913 were specific, a heavier duty falling, after 890, on those rods valued over 4 cents per pound than on those alued at 4 cents per pound or less. In the acts of 1894 and 1897 e duties were $\frac{3}{4}$ and $\frac{4}{10}$ cent per pound for these two classes; in e act of 1909, $\frac{6}{10}$ and $\frac{3}{10}$ cent. In the acts of 1897 and 1909, cent per pound additional duty was laid on those rods which were empered or treated.

COMPETITIVE CONDITIONS.

The import of wire rods comes very largely from Sweden. The uperiority of Swedish iron and steel rests, in general, on its greater urity, consisting in freedom from phosphorus and sulphur, resulting om the nature of the ore and the method of smelting. Much of e ore is particularly free from phosphorus and it is smelted with harcoal, a fuel freer from sulphur than coal or coke.

"Owing to the complete roasting of the ores and the freedom of e charcoal from *sulphur*, the Swedish pig iron is very free from lphur; the sulphur contained seldom amounts to 0.03 per cent; generally keeps below 0.02 per cent, and it frequently descends to bout 0.01 per cent and under.

[1] Production, calendar year 1914, plus imports for consumption for calendar year, minus domestic exrts for calendar year. $61,576,145+$547,699−$1,623,170=$60,500,674. Merely an estimate, since goods warehouses are not included.

"The *phosphorus* content is also, as a rule, low; but, as in Sweden there is a plentiful supply of ores rich in phosphorus as well as ores poor in phosphorus, pig iron may be made at pleasure with the most varying phosphorus contents, ranging from the iron rich in phosphorus needed for the basic Bessemer process to iron containing only about 0.01 per cent of phosphorus." [1] There are some extremely low phosphorus ores.

The uses which demand iron or steel of low phosphorus, and especially low sulphur, are various. Harness fixtures, for instance, must be free from sulphur, and iron for them has been imported from Sweden; so also must be steel for drawing seamless tubing. The rods imported are used to a great extent for the manufacture of horseshoe nails and of wire to be made up into wire rope, both of these uses demanding material of great purity.

Mr. C. Herbert Halcomb, of the firm of Halcomb & Davidson, New York City, said, relative to the ability of the American manufacturer to produce steel of a quality equal to the imported:

"I can state positively that if the American steel manufacturers, either crucible or open-hearth, are willing to use proper material and exercise the proper amount of care, they can produce steel equal to any make of Swedish." [2]

Relative to the use of wire rods in the manufacture of wire rope, the Hazard Co., of Wilkes-Barre, Pa., said:

"Have used domestic rods in all ropes manufactured since beginning of World War. Some domestic rods equal to those of English make for wire rope purposes. Wire made from English rods in some instances superior for toughness and wearing qualities for use on operations where conditions are favorable to long service. Practically no difference in point of view of service due to substitution" of domestic for foreign rods.[3]

The decrease in imports which has taken place since the outbreak of the war has resulted in the substitution of American rods for that portion formerly imported. In the manufacture of wire for wire rope, at least, this seems to have been done without detriment to the final product. With the advantage of superior quality gone, further imports of foreign goods depend upon the efficiency of foreign industry, in comparison with American, in the production of these grades of rods. This can be determined only after postwar readjustments have been completed.

The Federal Trade Commission, in the determination of the costs of iron and steel products during the war for the use of the Price-Fixing Committee of the War Industries Board and of certain purchasing departments of the Government, obtained the monthly cost sheets of the producing companies showing the average mill cost of producing wire rods from October, 1917, to December, 1918. These cost sheets were for mill costs and did not cover general administrative expenses or general depreciation. At the request of the Tariff Commission for information respecting the proportion of the various items of cost to the mill cost, the Federal Trade Commission compiled the costs as reported by five representative companies. They did not, of course, include any items for interest or for income

[1] L. Guinchard, editor, Sweden: Historical and Statistical Handbook, Stockholm, 1914.
[2] Letter of Oct. 3, 1918, to the commission.
[3] Answers to questionnaire received by the commission Oct. 5, 1918, p. 3.

ess-profit taxes. If the additional costs for general and admin-
ve expenses and for general depreciation could be determined
accuracy, there would be a substantial addition to the mill
s shown below.

se data have not as yet been published by the Federal Trade
ission and were furnished to the Tariff Commission with the
ient that they were subject to revision. While these figures
he reported mill costs for only five companies, it is believed
hey are sufficiently representative to show the relative impor-
of the particular items entering into mill costs.

Average mill cost of wire rods in dollars per gross ton.

Items of cost.	1917	1918			
	October to December.	January to March.	April to June.	July to September.	October to December.
on	636,879	402,058	546,845	594,730	512,912
l	$38.62	$41.47	$38.97	$41.64	$43.17	
	.51	.68	.54	.43	.46	
	1.77	1.99	2.13	2.27	2.69	
nce and repairs	.73	.75	.78	.85	.95	
	.12	.11	.12	.15	.20	
d power	1.70	2.05	1.66	1.87	2.05	
g and contingent	.04	.05	.06	.05	.05	
ts	.71	.81	.62	.71	.80	
l cost	44.20	47.91	44.88	47.97	50.37	
	Per cent of mill cost.				
l	87.38	86.56	86.83	86.80	85.71	
	1.15	1.42	1.20	.89	.92	
	4.00	4.16	4.75	4.74	5.35	
nce and repairs	1.65	1.56	1.74	1.78	1.89	
	.27	.23	.27	.31	.39	
d power	3.85	4.28	3.69	3.89	4.06	
g and contingent	.10	.10	.13	.10	.10	
ts	1.60	1.69	1.39	1.49	1.58	
l cost	100.00	100.00	100.00	100.00	100.00	

ention is called to the fact that the above costs are uncommonly
because of the abnormal industrial conditions prevailing at
me, brought about by the great European war. However,
ble brings out the fact that raw materials (billets) form over
· cent of the total cost, and as steel billets are made in large
ities in this country the American manufacturer of wire rods
no particular disadvantage with regard to obtaining sufficient
es for his needs.

or, the next largest item of manufacturing expense, forms only
l part of the total cost. In this connection, the fact that wages
ge lower in Europe than they do in the United States is worthy
e.

l at the pit mouth is higher in England than it is in the United
, but in the matter of transportation on fuel, raw materials,
n finished product for export England is at some advantage
son of a shorter haul.

TARIFF QUESTIONS.

Classification.—Acts previous to that of 1913 classified rods according to the value per pound of the rod. The act of 1909 provided that rods worth 4 cents or less per pound be taxed at a lower specific rate than those valued at more than 4 cents per pound, and that rods tempered or treated or partly manufactured bear an additional duty. This method of classification was simple but rested, as does an ad valorem duty, though to a less extent, upon valuations, and does not possess the certainty of an entirely specific duty.

The classification of the act of 1913 was more complicated, and the distinction made between rods of steel produced by the crucible, electric, or cementation process, and other processes, is to a large extent impossible of enforcement, and the higher duty laid on the former class is unimportant from the point of view of revenue. This classification seems the most logical when the protection given labor is considered, for a higher duty may be assessed on the product of that process which requires the greater amount of labor. That the present act actually affords such protection to the workers in the "crucible, electric, or cementation processes" is doubtful, because of the fact that it is impossible to distinguish at the customhouse between the steel produced by the processes mentioned and that made by other processes.

Horseshoe-nail rods were put on the free list when horseshoe nails were placed there. There was considerable importation of such rods for manufacture into horseshoe nails prior to June 30, 1915. (See Survey on Horseshoe Nails.)

EFFECTS OF THE WAR.

War demands for wire have led to an increase in the production of wire rods. Export has likewise increased. For the two years before the war (1913 and 1914) the average export was 65,658 gross tons per year. In 1915 the export was 98,441 gross tons, and in 1916, 171,529. In the last year Europe took 98,976 tons of this export, as against an average of 292 tons per year for the two years before the war. In the calendar year 1919 the export was 118,010 tons, of which Europe took 51,930.

The increase in export due to the war has gone to Great Britain, France, Italy, Japan, Spain, and Norway. Together with this expansion has gone an increase in the amount sent to all parts of the world: South America, which imported 2½ tons of wire rods from the United States in 1911 and 16 tons in 1913, in 1916 imported 96 tons, in 1917, 777, and in 1919, 572. Japan took 1,009 tons in 1915, 2,649 in 1916, 7,693 in 1917, and 32,079 in 1919.

Imports meantime have fallen off greatly. The average import for consumption for the two years 1913 and 1914 was 16,096 tons per year. In 1915 this import was 8,113 tons, in 1916, 4,719 tons, in 1919, 342. Of the total imports in 1919, Sweden sent 175, Denmark 16, Great Britain 28, and Canada 122 tons.

The effects of the war on prices is shown in the following table:

y prices of Bessemer wire rods, per gross ton, at Pittsburgh from January, 1914, to December, 1920.[1]

	1914	1915	1916	1917	1918 [2]	1919	1920
	$25.50	$25.00	$43.00	$75.00	$57.00	$57.00	$60.00
y	26.38	25.00	48.00	77.50	57.00	57.00	63.75
	26.50	25.00	54.80	81.00	57.00	55.75	70.00
	26.00	25.00	60.00	85.00	57.00	52.00	70.00
	25.50	25.00	60.00	86.00	57.00	52.00	72.50
	24.50	25.00	53.75	92.50	57.00	52.00	75.00
	24.50	25.63	53.75	96.25	57.00	52.00	75.00
	25.00	27.00	55.00	94.00	57.00	52.00	75.00
er	26.20	29.40	55.00	88.75	57.00	52.00	75.00
	25.88	31.75	55.00	77.25	57.00	52.00	75.00
er	25.25	36.25	63.00	[3] 57.00	57.00	54.50	66.40
ar	25.00	39.50	68.75	[3] 57.00	57.00	59.50	57.00

Iron Age, Jan. 6, 1920. February prices, 1914–1917, as corrected by the editor.
d prices.

Iron and steel wire rods—Production in United States, by States.

[From Federal Census. Calendar years.]

cities.	1899		1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
vania.	276, 395	$11, 240, 537	596, 892	(1)	861, 281	$23, 190, 920	1, 104, 133	$27, 959, 516
	241, 250	9, 863, 704	(2)	(1)	(2)	(2)	455, 925	11, 690, 793
	226, 050	(2)	(2)	(1)	449, 274	12, 022, 153	372, 161	9, 383, 885
usetts.	106, 279	(2)	(2)	(1)	(2)	(2)	.....	.....
	(2)	(2)	(2)	(1)	164, 869	4, 475, 203	.....	.....
r.	66, 613	14, 425, 288	1, 195, 812	(1)	819, 875	19, 964, 403	445, 472	12, 543, 951
tal.	916, 587	35, 529, 529	1, 792, 704	$52, 905, 031	2, 295, 279	61, 947, 958	2, 377, 691	61, 578, 145

[1] Included in total.

[2] Included in "All other."

Iron and steel wire rods—Production in United States.

[From American Iron and Steel Institute, Annual Statistical Report.]

Calendar year.	Quantity.	Calendar year.	Quantity.
	Gross Tons.		*Gross Tons.*
	846, 291	1910	2, 241, 830
	1, 365, 934	1911	2, 450, 453
	1, 574, 293	1912	2, 653, 553
	1, 503, 455	1913	2, 464, 807
	1, 699, 028	1914	2, 431, 714
	1, 808, 688	1915	3, 095, 907
	1, 871, 614	1916	3, 518, 746
	2, 017, 583	1917	3, 137, 138
	1, 816, 949	1918	2, 562, 390
	2, 335, 685	1919	2, 538, 476

STEEL WIRE RODS.

[From American Iron and Steel Institute, Annual Statistical Report.]

Calendar year.	Quantity.	Calendar year.	Quantity.
	Gross Tons.		*Gross Tons.*
	1, 574, 087	1911	2, 449, 843
	1, 503, 425	1912	2, 652, 264
	1, 607, 862	1913	2, 463, 975
	1, 807, 407	1914	2, 430, 983
	1, 870, 413	1915	3, 093, 671
	2, 016, 033	1916	3, 517, 879
	1, 816, 440	1917	3, 134, 851
	2, 335, 685	1918	2, 559, 401
	2, 241, 203	1919	2, 536, 520

Iron and steel wire rods—Production in United States—Continued.

IRON WIRE RODS.

[From American Iron and Steel Institute, Annual Statistical Report.]

Calendar year.	Quantity.	Calendar year.	Quantity.
	Gross Tons.		*Gross Tons.*
1902	206	1911	[illegible]
1903	30	1912	1,[illegible]
1904	1,166	1913	[illegible]
1905	1,281	1914	[illegible]
1906	1,201	1915	2,[illegible]
1907	1,550	1916	[illegible]
1908	509	1917	2,[illegible]
1909	[illegible]	1918	2,[illegible]
1910	627	1919	1,[illegible]

Iron and steel wire rods—Imports by countries.

Imported from—	Fiscal year— 1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Sweden	27,313,879	$583,322	32,178,723	$665,511	24,968,958	$522,0[illegible]
United Kingdom	6,679,[illegible]03	188,[illegible]90	7,443,481	187,411	5,046,378	146,1[illegible]
All other	1,216,450	17,974	1,436,956	33,539	580,823	9,[illegible]
Total	35,209,332	790,186	41,059,160	883,461	31,196,159	678,[illegible]

Imported from—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Sweden	30,961,113	$639,129	13,483,959	$413,572	8,148,206	$197,[illegible]
United Kingdom	7,3[illegible]4,889	191,114	6,412,809	181,869	2,411,332	68,[illegible]
All other	135,245	3,708	258,159	5,952	209,467	6,[illegible]
Total	38,401,247	833,951	28,154,927	601,393	10,769,005	272,[illegible]

Imported from—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
Sweden	9,231,295	$354,759	4,374,458	$278,417	2,135,482	$259,[illegible]
United Kingdom	1,036,435	38,782	59,416	4,528	87,732	13,[illegible]
Canada	[illegible]	[illegible]	53,892	3,197	12,692,396	401,[illegible]
All other	80,496	1,543	181,364	9,548	277,499	23,[illegible]
Total	10,348,226	395,084	4,669,130	295,690	15,193,109	697,[illegible]

Iron and steel wire rods—Imports by countries.

Imported from—	Calendar year— 1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Denmark			36,474	$3,[illegible]
Sweden	609,235	$72,998	393,327	40,[illegible]
England	91,338	13,015	62,866	7,[illegible]
Canada	16,256,700	514,136	273,230	11,[illegible]
All other	239,195	21,787	1,143	[illegible]
Total	17,196,528	621,936	767,040	63,[illegible]

Wire rods—Imports by customs districts.

ed at—	Fiscal year— 1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
fd	137,804	$2,885	120,870	$2,623	76,780	$1,668
harlestown	2,581,037	61,843	3,882,493	81,481	2,794,512	61,369
nn					293	5
J			17,677	697	4,291	126
	26,718,605	611,286	31,927,584	687,817	25,794,184	561,445
, Pa	4,810,171	102,542	5,064,681	109,945	2,444,235	52,057
; La					60,295	1,185
	148,451	2,819	44,830	839	4,210	113
					17,273	182
o			265	46		
l	786,515	8,402				
N. Y	25,349	379				
Y	2,000	30	760	13		
					86	13
	35,209,332	790,186	41,059,160	883,461	31,196,159	678,163

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
	(1)	(1)	(1)	(1)	1,118	$298
	(1)	(1)	(1)	(1)	152,216	3,360
ts	[2] 2,154,216	[2] $52,659	2,451,924	$53,963	2,357,725	55,721
	30,816,040	661,555	21,279,735	486,250	7,398,701	191,556
	5,018,537	110,171	1,451,466	34,163	471,588	13,064
	(1)	(1)	(1)	(1)		
	(1)	(1)	(1)	(1)	88	4
	(1)	(1)	(1)	(1)		
	(1)	(1)	708,806	18,798	387,569	8,284
	(1)	(1)	(1)	(1)		
	412,454	9,566	262,996	8,219		
	38,401,247	833,951	26,154,927	601,393	10,769,005	272,287

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
					177	$7
	100,711	$3,392				
ts	1,591,738	59,525	474,843	$36,112	245	53
	7,826,496	307,705	2,858,421	193,541	2,461,787	294,876
	748,785	22,919	1,283,474	62,916	78,128	4,901
	4,182	53	52,392	3,121	164	28
					665,812	20,869
e	5,555	156			20,000	1,189
	70,759	1,324				
l					11,927,800	374,214
					38,996	1,429
	10,348,226	395,084	4,669,130	295,690	15,193,109	697,548

[1] Included in all other.

[2] Boston and Charlestown.

Wire rods—Imports by customs districts—Continued.

	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Massachusetts	63,752	$3,347	40,881	$12,123
New York	939,828	107,800	452,929	39,935
Philadelphia	78,128	4,901	.....	.....
Rhode Island	15,436,200	494,133	.....	.....
Buffalo	164	28	167,447	6,631
Michigan	.....	.....	105,568	4,088
Vermont	665,812	20,860	.....	.....
All other	12,644	867	215	25
Total	17,196,528	621,936	767,040	63,573

Imported at—	Fiscal year—							
	1912-1914.				1915-1917.			
	Quantity.		Value.		Quantity.		Value.	
	Pounds.	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
New York, Massachusetts, Philadelphia	94,204,849	98.38	$2,073,632	98.11	25,011,771	97.00	$943,059	97.93
All other districts	1,547,484	1.62	39.875	1.89	774,590	3.00	20.002	2.08
Total	95,752,333	100.00	2,113,507	100.00	25,786,361	100.00	963,061	100.00

IMPORTS FOR CONSUMPTION.

Wire rods—Rivet, screw, fence, and other iron or steel wire rods, whether round, oval, flat, square, or in any other shape, etc.

UNTEMPERED AND UNTREATED—VALUED AT 4 CENTS OR LESS PER POUND.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1908	$\frac{1}{10}$ cent per pound	28,182,250	$649,121	$116,729	$0.022	17.98
1909	do	25,207,040	550,236	100,828	.022	18.32
1910	do	2,132,663	47,994	8,530	.022	17.77
	$\frac{1}{10}$ cent per pound	33,973,454	736,966	101,920	.022	13.83
	$\frac{1}{11}$ cent per pound [1]	1,008	33	4	.033	12.97
1911	$\frac{1}{10}$ cent per pound	41,795,749	885,927	125,387	.021	14.15
1912	do	31,608,120	681,415	94,824	.022	13.92
1913	do	38,779,210	834,336	116,337	.022	13.94
1914	do	6,601,988	146,871	19,805	.022	13.48

UNTEMPERED AND UNTREATED—VALUED AT OVER 4 CENTS PER POUND.

1908	$\frac{1}{5}$ cent per pound	225,680	$15,460	$1,692	$0.068	10.95
1909	do	94,216	6,797	706	.072	10.40
1910	$\frac{1}{5}$ cent per pound	261,617	20,977	1,569	.080	7.48
	$\frac{1}{4}$ cents per pound [1]	595	151	6	.258	4.19
1911	$\frac{1}{5}$ cent per pound	94,864	8,071	569	.085	7.05
1912	do	835	63	5	.075	7.97
1913	do	22,120	1,624	132	.073	8.17
1914	do	5,791	436	34	.075	7.97

[1] Cold-rolled, cold-drawn, cold-hammered, or polished in any way.

rivets, fence, and other iron or steel wire rods, whether round, oval, flat, square, or in any other shape, etc.

) OR TREATED OR PARTLY MANUFACTURED—VALUED AT 4 CENTS PER POUND OR LESS.

r.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$\frac{1}{10}$ cent per pound.	2,369	$57	$21	$0.024	37.42
.....	.....do.....	21,281	473	191	.022	40.49
.....	$\frac{1}{10}$ cent per pound.	151,124	2,880	1,209	.019	42.00
.....	.....do.....	44,830	839	358	.019	42.75
.....	$\frac{1}{10}$ cents per pound.	67,199	1,366	537	.020	39.36
.....	.....do.....	11,200	243	89	.022	36.87

) OR TREATED OR PARTLY MANUFACTURED—VALUED AT OVER 4 CENTS PER POUND.

.....	$1\frac{1}{2}$ cents per pound.	279	$56	$3	$0.200	6.23
.....	.....do.....	4,822	270	54	.062	20.01
.....	$1\frac{3}{10}$ cents per pound	7,086	373	77	.053	20.90
.....	$1\frac{3}{10}$ cents per pound	506	151	6	.298	4.10
.....	$1\frac{1}{10}$ cents per pound	1,307	243	14	.186	5.92
.....						
.....						

rivet, screw, fence, nail, and other iron or steel wire rods, whether round, oval, or square, or in any other shape, etc.

		Pounds.				*Per cent.*
.....	10 per cent.....	18,062,389	$419 097	$41,909	$0.023	10.00
.....	.....do.....	10,261.752	257.542	25,754	.025	10.00
.....	.....do.....	9,653,452	365,049	36,504	.038	10.00
.....	.....do.....	3,657,558	243,560	24,356	.067	10.00
.....	.....do.....	14,455,749	616.271	61,627	.043	10.00
.....	.....do.....	4,311,457	141,306	14.131	.033	10.00
.....	.....do.....	2,364,177	125,203	12,520	.053	10.00

Wire rods—horseshoe-nail.

		Pounds.				*Per cent.*
.....	Free.....	7,260,596	$128,980	.....	$0.018	.....
.....	.....do.....	7,312,441	129,114	.....	.018	.....
.....	.....do.....	.....	.....	.....	.....	.....
.....	.....do.....	.....	.....	.....	.....	.....
.....	.....do.....	.....	.....	.....	.....	.....
.....	.....do.....	.....	.....	.....	.....	.....
.....	.....do.....	40	2	.....	.05	.....

ivet, screw, fence, rail, etc., cold-rolled, cold-drawn, cold-hammered, or polished.

		Pounds.				*Per cent.*
.....	10 per cent.....	643,991	$13,940	$1,394	$0.022	10.00
.....	.....do.....	.....	.....	.....	.....	.....
.....	.....do.....	327,988	11,404	1,140	.035	10.00
.....	.....do.....	832,564	40,861	4,086	.049	10.00
.....	.....do.....	687,172	74,687	7,468	.109	10.00
.....	.....do.....	98,914	8,824	882	.089	10.00
.....	.....do.....	991,772	65,296	6,530	.066	10.00

, cold-drawn, cold-hammered, or polished in any way.

Wire rods, rolled wire rods in coils or bars, not smaller than twenty one-hundredths in diameter, etc.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actua comp ad val rat
		Pounds.				*Per c*
1914	15 per cent	634,926	$34,390	$5,158	$0.054	
1915	do	596,991	17,184	2,577	.029	
1916	do	589,301	22,407	3,361	.038	
1917	do	143,606	11,269	1,690	.078	
1918	do	46,863	6,198	929	.132	
1919	do	97,730	8,520	1,278	.087	
1920	do	130,838	15,325	2,299	.117	

Iron and steel wire rods—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	171,640	$2,351	57,940	$815	131,790	$1
Canada	55,472,897	781,335	39,651,901	527,306	107,165,887	1,412
All other	226,443	5,507	56,261	1,083	78,391	1
Total	55,870,980	789,193	39,766,102	529,204	107,376,068	1,418

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
France					53,677,493	$958,
United Kingdom	1,069,256	$15,355	193,018	$2,439	80,098,759	$1,059,
Canada	164,948,617	2,134,198	126,216,540	1,617,939	81,923,811	937,
Japan					2,261,226	40,
All other	1,585,599	29,116	134,575	2,792	2,575,947	39,
Total	167,603,472	2,178,669	126,544,133	1,623,170	220,507,236	2,744,

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
France	72,653,501	$1,206,619	72,530,264	$2,522,188	43,786,685	$2,244,
Italy	2,082,399	63,421	20,325,540	634,755	120,984,457	4,636,
United Kingdom	144,702,800	2,408,576	85,976,511	2,396,424	69,460,473	2,849,
Canada	154,982,711	2,200,402	108,740,061	2,718,661	94,538,676	2,927,
Japan	5,933,125	130,321	17,231,842	778,793	65,532,922	3,178,
All other	3,870,963	73,919	24,972,320	818,865	23,641,829	1,018,
Total	384,225,538	6,083,258	329,785,538	9,869,686	417,945,042	16,858,

Wire rods (iron and steel)—Domestic exports (calendar years).

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Denmark	1,441,310	$59,104	14,496,458	$424
France	55,804,863	2,355,588	32,761,448	1,111
United Kingdom	61,785,455	2,408,496	14,559,224	499
Canada	34,752,548	1,119,742	49,459,746	1,424
China	87,876,175	2,713,335	60,858,124	1,558
Japan	2,532,459	79,265	3,947,297	87
Australia	66,130,690	2,746,598	71,858,057	2,730
All other	4,822,902	185,332	8,227,171	255
	17,545,467	802,255	8,174,791	283
Total	332,691,869	12,469,715	264,342,316	8,374

Steel wire rods—Prices (wholesale or retail) per gross ton at Pittsburgh.

[From American Iron and Steel Institute, Annual Statistical Report.]

1910	$30.37	1915	$28.30
1911	27.40	1916	55.84
1912	26.28	1917	[1] 57.00
1913	28.40	1918	[1] 57.00
1914	25.52	1919	53.99

NOTE.—Monthly and weekly prices are given in the Iron Age and the Iron Trade Review; daily in the American Metal Market and Daily Iron and Steel Report.

COURT AND TREASURY DECISIONS.

Polished steel rods commonly and commercially known as drill rods, or as stubbs steel, which were in fact used for making drill rods, were held dutiable under paragraph 124 of the act of 1894 as drill rods and not under paragraph 122 for steel in all forms and shapes, n. s. p. f. (United States *v.* Frasse, 94 Fed., 483.) The words "cold rolled * * * or polished by any process to such perfected surface finish, or polish better than the grade of cold-rolled, smoothed only," in paragraph 141 of the act of 1897, were declared to have been used with the meaning theretofore given them by custom authorities under similar acts and, therefore, were held not to include strips whose only polish or brightening was incidentally acquired during cold rolling and which were not included in similar former provisions. (United States *v.* Crucible Steel Co., 154 Fed., 1005.) The provision in the same paragraph for "iron * * * rods * * * cold drawn, * * * in addition to the ordinary process of hot rolling" imposing a duty on rods which are hot rolled, was construed not to subject wire screw rods cold drawn after being hot rolled to additional duty, regardless of the fact that such articles were specially enumerated in another paragraph as "wire screw rods" and that cold drawing is a necessary part of the process of making such rods. (United States *v.* Nash, 158 Fed., 401.)

Goods sold as iron wire rods and used as such in the United States were held to come within the provision in paragraph 113 of the act of 1913 for "Rivet, screw, fence, nail, and other iron or steel wire rods." (Swedish Iron and Steel Corporation *v.* United States, 6 Ct. Cust. Appls., 225, of 1916, distinguishing Athenia Steel & Wire Rod Co. *v.* United States, 1 Ct. Cust. Appls., 494, of 1911, in which it was held that steel bands about 3 inches wide, $\frac{1}{8}$ inch thick, and 30 feet and over in length, imported in coils, and requiring after importation to be put through rolls and rolled down into longer lengths and a much thinner thickness, and to be put through another machine to be slit into narrow widths, were not flat wire rods within paragraph 36 of the act of 1897, but dutiable under the provision in paragraph 37 for "steel in all forms and shapes" n. s. p. f.)

[1] Fixed price, since Oct. 11, 1917.

RATES OF DUTY.

Iron and steel wire rods.

Act of—	Par.	Tariff classification or description.	Rates of duty, s and ad valore
1890	147	Wire rods: Rivet, screw, fence, and other iron or steel wire rods and nail rods, whether round, oval, flat, square, or in any other shape, in coils or otherwise, not smaller than No. 6 wire gauge—	
		Valued at 3½ cents or less per pound	⅛ cent per poun
		And iron or steel, flat, with longitudinal ribs for the manufacture of fencing, valued at 3 cents or less per pound.	Do.
		Provided, That all iron or steel rods, whether rolled or drawn through dies, smaller than No. 6 wire gauge, shall be classed and dutiable as wire.	
1894	123	Wire rods: Rivet, screw, fence, and other iron or steel wire rods, whether round, oval, flat, or square, or in any other shape, and nail rods, in coils or otherwise—	
		Valued at 4 cents or less per pound	⅛ cent per poun
		Valued over 4 cents per pound	¼ cent per pound
		Provided, That all round iron or steel rods smaller than No. 6 wire gauge shall be classed and dutiable as wire.	
1897	136	Wire rods: Rivet, screw, fence, and other iron or steel wire rods, whether round, oval, flat, or square, or in any other shape, and nail rods, in coils or otherwise—	
		Valued at 4 cents or less per pound	⅛ cent per poun
		Valued over 4 cents per pound	¼ cent per pound
		Provided, That all round iron or steel rods smaller than No. 6 wire gauge shall be classed and dutiable as wire: *Provided further*, That all iron or steel wire rods which have been tempered or treated in any manner or partly manufactured shall pay	¼ cent per pound tional.
1909	134	Wire rods: Rivet, screw, fence, and other iron or steel wire rods, whether round, oval, flat, or square, or in any other shape, and nail rods, all the foregoing in coils or otherwise—	
		Valued at 4 cents or less per pound	⅛ cent per poun
		Valued over 4 cents per pound	⅛ cent per poun
		Provided, That all round iron or steel rods smaller than No. 6 wire gauge shall be classed and dutiable as wire: *Provided further*, That all iron or steel wire rods which have been tempered or treated in any manner or partly manufactured shall pay	¼ cent per pound tional.
1913	110	Steel bars, and tapered or beveled bars: mill shafting; pressed, sheared, or stamped shapes, not advanced in value or condition by any process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun-barrel molds not in bars; all descriptions and shapes of dry sand, loam, or iron molded steel castings, sheets, and plates; all the foregoing, if made by the Bessemer, Siemens-Martin, open-hearth or similar processes, not containing alloys, such as nickel, cobalt, vanadium, chromium, tungsten or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys, 8 per cent advalorem; steel ingots, cogged ingots, blooms and slabs, die blocks or blanks; billets and bars and tapered or beveled bars, pressed, sheared, or stamped shapes not advanced in value or condition by any process or operation subsequent to the process of stamping; hammer molds or swaged steel; gun-barrel molds, not in bars; alloys used as substitutes for steel in the manufacture of tools; all descriptions and shapes of dry sand, loam, or iron molded castings, sheets, and plates; rolled wire rods in coils or bars not smaller than twenty one-hundredths of 1 inch in diameter, and steel not specially provided for in this section, all the foregoing when made by the crucible, electric, or cementation process, either with or without alloys, and finished by rolling, hammering, or otherwise, and all steels, by whatever process made, containing alloys such as nickel, cobalt, vanadium, chromium, tungsten, wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron, and similar alloys	15 per cent ad va
1913	113	Rivet, screw, fence, nail, and other iron or steel wire rods, whether round, oval, or square, or in any other shape, and flat rods up to 6 inches in width, ready to be drawn or rolled into wire or strips, all the foregoing in coils or otherwise, including wire rods and iron or steel bars, cold rolled, cold drawn, cold hammered, or polished in any way in addition to the ordinary process of hot rolling or hammering, not specially provided for in this section	10 per cent ad va
		Provided, That all round iron or steel rods smaller than twenty one-hundredths of 1 inch in diameter shall be classed and dutiable as wire.	
1913	554	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe nail rods, hobnails, and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs	Free.

IRON AND STEEL WIRE, PLAIN AND COATED.

SUMMARY.

article covered by this survey—iron and steel round wire, ıer plain or coated—is provided for under paragraph 114 of the 1913, which levies an ad valorem duty of 15 per cent, and under raph 645, which admits baling wire and galvanized fence wire The amount of wire admitted under the latter paragraph is ible.

DOMESTIC PRODUCTION AND IMPORTS.

the calendar year 1914, the United States produced 834,387 f iron and steel wire, plain and coated, valued at $38,266,309. was a year of relatively small production. In the fiscal year imports amounted to 7,725 tons, valued at $806,594, thus ıg 0.92 per cent of the quantity and 2.11 per cent of the value ced in the calendar year. Round iron and steel wire is not ıtely specified in the export statistics, but included under the n "wire and manufactures of wire." It is clear, however, that ordinary grades of wire, the domestic production is in excess nestic consumption.

1914, Pennsylvania contained slightly over one-third of the rawing blocks of the United States; Illinois and Ohio, between slightly less than one-third, while the remaining third was red, Alabama, Colorado, Massachusetts, New Jersey, and ıa all having approximately 5 per cent apiece.

SIGNIFICANCE OF THE IMPORTS.

r to the recent war, imports, though small in relation to ction, had been fairly constant in amount. Explanation for mports is to be found in the fact that the foreign wire (largely h) was thought superior to that of domestic manufacture for ı uses demanding wire of very fine quality. Such uses were ler of drawbacks paid in 1913 on exported articles containing ı wire) the manufacture of wire rope, needles, musical instru-, passenger cars, electrical machinery, and automobiles. The ority of the foreign wire rested on its greater purity—freedom phosphorus and sulphur—due to the use of ores of greater and processes leaving fewer impurities in the steel. As long condition existed, imports were constant in amount, and the night well be regarded as a revenue duty falling upon this ılar raw material used in the manufacture of the above-ned articles.

e the decrease in imports which has followed the outbreak of r, American wire has been substituted in the manufacture of pe for that portion of the wire formerly foreign, during a time

when the manufacture of wire rope was rapidly increasing to meet war demands. The result has been generally satisfactory, though one company has ceased to manufacture its best grade of rope since the English wire has become unobtainable.

Under present conditions it is doubtful whether the importation of wire will continue in any quantity under the present rates, for the former advantage in quality—for rope wire at least—seems to have disappeared. Whether the foreign production will be at less cost than the domestic in these grades of wire can be judged only after the post-war readjustment is completed.

Iron and steel wire, plain and coated—Summary table.[1]

[Tons of 2,000 pounds.]

Year.	Domestic production.[2]	Imports for consumption.[3]	Domestic exports.[3]	Ratio imports to production.		Value (imports for consumption.)[3]	Amount of duty.[3]	Value per pound.	Actual or equivalent ad-valorem rate.
				Quantity.	Value.				
	Tons.	*Tons.*		*Per cent.*	*Per cent.*			*Cents.*	*Per cent.*
1909	826,451	7,073		0.87	1.64	$635,721	$265,602	4.49	41.6
1910		9,324				907,999	348,732	4.86	38.4
1911		9,632				867,760	331,054	4.50	38.2
1912		6,432				650,504	247,436	5.06	38.0
1913		7,158				790,358	293,540	5.52	37.1
1914	834,387	[4] 7,725		.92	2.11	808,594	157,352	[5] 5.07	19.5
1915		[4] 5,114				486,922	72,993	[5] 4.70	15.0
1916		[4] 885				112,424	16,707	[5] 6.20	14.9
1917		[4] 219				48,633	7,161	[5] 9.76	14.7
1918		[4] 27				13,922	2,026	[5] 23.89	14.6
1919		[4] 72				52,335	7,065	36.39	13.5
1920		2,322				3,379	43,144	7.28	12.8

[1] Plain wire specified as round; coated not. The latter formed but 3.21 per cent of the value of the imports under the act of 1913.
[2] Calendar years.
[3] Fiscal years ending June 30.
[4] Excluding coated other than baling and galvanized fence since Oct. 4, 1913, for which figures for quantity are not available.
[5] Not specified.

General Information.

TARIFF PARAGRAPHS, ACT OF 1913.

Paragraph 114: Round iron or steel wire; wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material: * * * iron and steel wire coated by dipping, galvanizing, or similar process with zinc, tin, or other metal; all other wire not specially provided for in this section * * * all the foregoing, 15 per cent ad valorem.

Paragraph 645: * * * galvanized wire not larger than twenty one-hundredths of one inch in diameter and not smaller than eight one-hundredths of one inch in diameter of the kind commonly used for fencing purposes, galvanized wire fencing composed of wires not larger than twenty one-hundredths of one inch in diameter nor smaller than eight one-hundredths of one inch in diameter, and wire commonly used for baling hay or other commodities. Free.

DESCRIPTION.

Of the total production of iron and steel wire, iron wire forms but a small percentage. In 1914 iron wire rods formed but slightly more than 0.1 per cent of the tonnage of iron and steel wire rods used by the wire industry.[1] A portion of this iron wire is used in the construction of wire rope for elevators.

Steel wire differs in physical properties according to the carbon content of the wires. When this is below approximately 0.3 per cent, the wire is called "mild" wire. The bulk of American production is made up of this grade of wire, which is used for fencing and telegraph and telephone wire. Wire of higher carbon content, which has greater tensile strength, hardness, and stiffness, is used for the manufacture of springs, wire rope, needles, music wire, and other products. Such wire is designated as high carbon, and according to its use, as rope or needle wire.

Wire may be coated, after drawing, with metal—usually zinc or tin. When coated with the former, it is called galvanized wire. Wire as it comes from the drawing dies is called plain or bright wire.

Wire is graded according to its size, which is measured by the use of a wire gauge, indicating its diameter.

Tariff acts previous to that of 1913 classified round iron and steel wire according to its value and gauge, and laid an additional duty upon that which was coated. The act of 1913 dropped these classifications, laying the same rate of duty on plain and coated wire and admitting baling wire and galvanized fence wire free.

DOMESTIC PRODUCTION.

Quantity.—Prior to 1909 the census does not classify plain or coated wire separately. In that year the United States produced 826,451 tons (2,000 pounds) of plain and coated iron and steel wire, valued at $38,845,081, and in 1914, 834,387 tons, valued at $38,266,309.

The figures of total production of wire and wirework which are given (in values) by the two preceding censuses are not directly comparable with the totals of 1909 and 1914. A better indication of the general growth of the wire industry than such totals may be found in the increase in the production of rods. "The output of iron and steel wire rods in 1899 was 916,587 long tons, and in 1904 1,792,704 tons; in 1909, 2,295,279 tons; and in 1914, 2,377,691 tons, showing increases for the successive five-year periods of 95.6 per cent, 28 per cent, and 3.6 per cent, respectively."[2] It may be pointed out that 1914 was a year of relatively small production. (See Survey on Wire Rods.)

Methods and processes.—Wire rods come in coils and vary in thickness, the ordinary commercial size being a No. 5 gauge, a little less than a quarter of an inch in diameter. The rods are drawn through successively smaller dies, until the desired thickness is reached. The dies are blocks of chilled cast or steel plates, in which tapered holes have been drilled. They stand between two reels, one of which holds the rods; the other, driven by power, draws the wire through the die and reels it up. Previous to the drawing process the rods have to be cleaned—that is, immersed in a hot solution of sulphuric acid to re-

[1] Establishments drawing wire.
[2] Census of Manufactures, 1914. Iron and Steel, Washington, 1917. Pp. 52-53.

move the coat of hard material which is formed on their surface during the rolling process. They are then dipped in a lime bath to remove the acid and to give a coat to aid in lubrication in the drawing process. Next, they are heated in a dry house, which further removes any of the bad effects of the acid on the metal. They are then ready for drawing. During the process of drawing it is necessary to reheat (anneal) the wire, in order to prevent its becoming too hard. After the annealing, the wire has to be recleaned, run through the lime-water bath, and rebaked, just as the wire rods are first treated.

No development comparable to that which has taken place in the manufacture of wire rods (see Survey on Iron and Steel Wire Rods) has taken place in wire drawing. None of the steps in annealing, cleaning, and lubricating the wire have been eliminated. The continuous principle has not been successfully developed in the drawing of iron and steel wire, except for the smaller sizes. Varying demands of customers and variations in the temper and uniformity of the gauge of rods have made continuous drawing impracticable. Copper, brass, aluminum, and the precious metals, have been more manageable on continuous drawing machines.

Foreign processes are similar to that used in the United States.

Wage earners.—The industry employs adult males. In 1914 wire mills purchasing wire rods employed an average of 17,600 wage earners, 708, or 4 per cent, of whom were women, and only 10 were under 16 years of age. A similar condition exists in the establishments rolling rods. In 1914 the steel works and rolling mills employed an average of only 979 women (0.4 per cent of the wage earners) and only 725, or 0.3 per cent, under 16 years of age.

Materials and equipment.—The raw material for iron and steel wire is rods of these metals. In 1909 the wire industry [1] consumed 2,514,504 tons of steel rods and 4,849 of iron, valued, respectively, at at $67,439,887 and $207,846; in 1914, 2,495,201 tons of steel and 2,579 tons of iron, valued at $59,161,732 and $121,651.

The relative importance of the different kinds of steel used in the production of steel wire is indicated by the kinds of rods consumed. The following table presents the amount of Bessemer, open-hearth, and crucible and other steel wire rods used by the wire industry in 1909 and 1914:

Materials used by the wire industry—Steel wire rods.

[Tons of 2,000 pounds.]

Process.	Quantity used.			
	1914		1909	
	Tons.	Per cent of total.	Tons.	Per cent of total.
Bessemer	948,552	38.01	1,148,353	45.67
Open hearth:				
Total	1,540,495	61.74	1,359,256	54.06
Basic	1,483,968	59.47	1,255,747	49.94
Acid	56,527	2.27	103,509	4.12
Crucible and other	6,154	.25	6,895	.27
Total	2,495,201	100.00	2,514,504	100.00

[1] Including all establishments drawing wire, whether their product is wire, as treated in this catalogue, or wire nails, wire tacks, brads, or staples, barbed wire, wire rope and strand, woven-wire fence and *poultry netting*, other woven-wire products, or other fabricated iron and steel wire products.

Prior to the war imports of wire rods were regular and persistent. or the fiscal year ended June 30, 1914, the total import of wire rods r consumption was 16,620 long tons (less than 0.7 per cent of the oduction for the calendar year 1914), valued at $743,957. The bulk this importation was from Sweden and the United Kingdom, and nsisted of high-carbon steel rods, for the manufacture of wire-rope ire and other high-carbon steel wire; also low-carbon rods for the anufacture of horseshoe nails and other specialties. (See Survey n Wire Rods.)

The relative importance of the zinc used for galvanizing may be idged by the price differential between plain and galvanized wire. his was 30 cents per 100 pounds of wire in 1910 (low price for year, lain, $1.50 plus 30 cents = $1.80). This differential rose to 80 cents etween June 1 and August 6, 1915 ($1.30 plus $0.80 = $2.10), and as constant at 70 cents for the three years 1916–1918. In the last ear the Government price of plain was $3.25. The 70-cent differtial gives a price of $3.95 for galvanized. The percentage added y galvanizing thus varied from 20 per cent (1910) to 61.5 per cent June 1–Aug. 6, 1915) and stood at 21.5 per cent under Government rice fixing. (See Survey on Zinc for information regarding this etal.)

Wire drawing is ordinarily done on a wire-drawing bench, to which number of reels and dies are attached, the unit thus drawing a umber of wires at the same time. Cold-drawn shafting and wires f large diameter are drawn on a machine called a bull block, a complete unit handling a single shaft or wire rod and ordinarily equipped ith an electric motor for drive. There has been a tendency to push ne line between wire (handled in reels) and cold-drawn bars (handled straight pieces) to larger and larger diameters, cold-drawn pieces f as large as 1¼ inches in diameter being handled as wire.

Electricity is playing an increasingly important part as a motive ower for wire drawing. The electrical equipment of mills purchasg rods had a capacity of 39,458 horsepower in 1914, equal to 47 er cent of the total horsepower used. In 1909 this percentage was 6.2, in 1904, 6.61. There is a similar change in the wire departents of steel mills. This increase in the use of electrical power is ue to the convenience of supplying each machine with its own otor, since not all of them are to be kept going at the same time. similar development, because of the advantages of a separate drive r each machine, has taken place in other industries.

Organization and capitalization.—There is about an equal division f product between those mills which purchase their rods and those hich are departments of rolling mills and other concerns. In 1914, 62,591 tons of plain and coated wire, valued at $20,044,583, were ade by mills purchasing rods, 471,796 tons, valued at $18,221,726, y wire departments of rolling mills and other concerns. The establshments purchasing rods thus made 43.46 per cent of the weight d 52.38 per cent of the value of the plain and coated iron and steel ire produced. In 1909 these percentages were 41.61 and 48.46, spectively.

The wire industry is one of large plants. Of the 54 establishents in the United States in 1914 which made wire and its products m purchased rods, only 12 produced a product of less than 00,000; 21 between $100,000 and $1,000,000, and 21 over

$1,000,000. The last group made 86.1 per cent of the product Recent growth has been toward the concentration of the industry in large plants.

The industry is one of widespread corporate ownership. In 1914, 99.3 of the value of the products made by mills purchasing rods were manufactured by firms under corporate ownership. The rolling-mill industry—of which the wire mills making their rods form a part—is likewise one largely under corporate control. (See Survey on Iron and Steel Wire Rods.)

Localities of production.—The chief wire-producing regions of the United States are indicated by the annual capacity of the wire-drawing blocks in the United States in 1914.

Annual drawing capacity of the wire-drawing blocks in the United States in 1914.[1]

	Tons.
United States	3,852,000
Pennsylvania	1,328,000
Illinois	619,000
Ohio	575,000
Alabama	228,000
Colorado	210,000
Massachusetts	209,000
New Jersey	208,000
Indiana	195,000
Connecticut	95,000
New York	82,000
Rhode Island	47,000
All others	56,000

Establishments drawing wires are thus located in the same regions as the steel works and rolling mills. These form the great industrial center of the United States, with iron and coal supplies readily available, labor plenty, and consuming centers near at hand.

Relation of domestic production to domestic consumption. The export statistics cover iron and steel wire, other than barbed; the production statistics, plain and coated iron and steel wire; the import statistics (since Oct. 3, 1913), round iron and steel wire, coated wire, baling wire, and galvanized fence wire. The use of these figures to estimate consumption would involve error, though probably not one of great size. For 1911 the value of the exports of all other iron and steel wire, except barbed, was $3,800,000, against an import of $807,000 of round iron and steel wire, coated wire, galvanized fence wire, and baling wire. Although the export figures may cover some wire not contained in the import figures, the much greater export indicates a domestic production in excess of domestic consumption. This is especially true in the ordinary grades of wire, for imports are largely made up of wire of special quality for particular purposes.

Exports.—Exports of iron and steel round wire, plain and coated, are included under exports of all other iron and steel wire in the figures given by Commerce and Navigation. This classification excludes barbed wire and manufactures of wire.

For the two fiscal years 1910 and 1911 exports of all other wire averaged annually 108,916 tons, valued at $4,815,616; for the three fiscal years 1912–1914, 135,553 tons, valued at $5,503,338; and for the three fiscal years 1915–1917, 72,264 tons, valued at $15,258,309.

[1] All blocks, including those used to draw other metals as well as iron and steel.

exports of all other wire went (in order of their importance)
. Australia, Argentina, Mexico, and New Zealand. In 1914
Mexico had decreased, New Zealand and the United King-
ing a greater amount. In 1917 France received the largest
llowed by Canada, Argentina, the United Kingdom, Brazil,
ı.

—Puddled iron was the material used for wire before the
50–1870, when Bessemer steel was first put to this use. It
but did not displace iron. Later came the use of open-
el, which could be more economically drawn. The intro-
the electric drive (1892) marks another step in the progress
wing.[1] During these years a great development took place
cess of rolling wire rods. (See survey on Iron and Steel
.)

FOREIGN PRODUCTION.

s of largest production.—The Iron and Steel Manufacturers'
ı (British) estimated the production of iron and steel wire
y at 1,000,000 tons in 1913, and that of Great Britain at
-less than one-half and one-tenth of the most nearly com-
ure for the United States, the production of iron and steel
vire products in 1914, 2,465,383 short tons. France and
e also important producers.

IMPORTS.

'.—During the six fiscal years 1909–1914 imports of iron
wire varied from 6,432 short tons, valued at $650,503.67
9,324 tons, valued at $907,959.15 (1910), averaging approx-
900 tons in amount and $776,500 in value. Imports for
ear 1914—7,725 tons.[7] $806,594—formed 0.92 per cent of
ty and 2.10 per cent of the value of plain and coated iron
vire on hand during the calendar year 1914.
)14 there has been a large decline in imports. In 1916
only 865 tons,[8] valued at $112,424, and in 1918 27 tons,[8]
$13,922.
–Plain and coated iron and steel round wire is not specified
in the statistics of imports by countries given by Commerce
ation. Such imports are included under imports of iron
vire and manufactures of wire. These imports indicate the
he imported, plain, and coated iron and steel wire. In 1917
principally from the United Kingdom, Sweden, France,
a. In the last fiscal year unaffected by the war (1914) the
ngdom sent the largest amount, followed by Germany,
nada, and Sweden.
ind varieties.—Under the act of 1897 round iron and steel
lassified according as it was valued at 4 cents per pound or
r 4 cents per pound. From July 1, 1906, to August 5, 1909,
s were imported under this act. Plain round wire made
r cent of this total; 36 per cent of it was valued at 4 cents
Of the galvanized wire, which formed 1.3 per cent of the
.3 per cent was valued at 4 cents or less.

. The History of Wire Manufacture. The Engineer, vol. 124, pp. 334–336.
. Coal Trades Review, June 14, 1918, p. 668.
lvanized other than fence and baling since Oct. 4, 1913, for which figures for quantity are
negligible omission.

The classification of the act of 1909 was according as the specific duty formed 35 per cent of the value of the wire. Under this act (Aug. 6, 1909, to Oct. 3, 1913) 33,326 tons were imported. Plain wire formed 98.15 per cent of this total. On 60 per cent of the plain wire the specific duties provided in the act amounted to over 35 per cent (low-valued wire). On the galvanized wire, which formed 1.85 per cent of the import, the specific duties amounted to over 35 per cent on 30.8 per cent of the import (low-valued wire).

The act of 1913 classified wire into round, coated, baling, and galvanized fence. For the second class no figures are given for quantity in Commerce and Navigation. Under this act from October 4, 1913, to June 30, 1917, wire valued at $1,289,854 was imported; 96.5 per cent of this was round wire, 3.2 per cent coated, 0.16 per cent baling, and 0.14 per cent fence (galvanized). The total coated wire thus forms 3.34 per cent of the import; the total plain, 96.66 per cent.

The imports of iron and steel round wire for agricultural purposes thus was a negligible amount—a yearly average of 19 tons from October 4, 1913, to June 30, 1917. This quantity forms 0.6 per cent of the total import and only an extremely insignificant fraction of the total available supply of iron and steel wire, plain and coated.

The following table presents, in greater detail, the figures which have been given. It covers statistics for import, duties collected, value per unit of quantity, and computed ad valorem rate, according to the four classifications of wire as they stood under the three acts: For the act of 1897 from July 1, 1906, to August 5, 1909; for the act of 1909, August 6, 1909, to October 3, 1913; and for the act of 1913, October 4, 1913, to June 30, 1917.

Iron and steel round wire, plain and coated—Imports for consumption—Revenue.

Date.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual ad valorem rate.
		Short tons.				*Per cent.*
July, 1906...	Specific[1].....	8,403	$380,915.11	$170,776.57	$0.031	44.81
Aug. 5, 1909	Ad valorem[2].....	17,081	1,651,732.00	630,896.80	.054	38.19
	Specific[3].....	909	125,709.00	35,718.28	.050	28.42
	Mixed[4].....	200	31,708.00	14,567.37	.079	45.93
Total.....		28,853	2,250,164.11	837,849.17	.017	41.64
Aug. 6, 1909.....	Specific[3].....	19,720	1,481,111.70	607,785.24	.038	41.04
Oct. 3, 1913.....	Ad valorem[2].....	12,784	1,751,...67	612,...1.20	.067	35.00
	Specific[5].....	140	14,...27.00	6,511.55	.037	46.11
	Mixed[4].....	626	92,179.00	31,...8.25	.101	36.45
Total.....		33,...8	3,338,...3.37	1,...1,...0.24	.050	37.79
Oct. 4, 1913.....	15 per cent[6].....	14,...80	1,...,...00	186,...3.80	.051	15.00
June 30, 1917...	do.....		81,...83.00	...,...2.15		15.00
	Free[7].....	5	2,...7.00	.....	.032	.....
	Free[8].....	58	1,...2.00	.....	.021	.....
Total.....		1,...79	1,...,...1.00	192,...8.5	.....	14.45

[1] Paragraph ... of act of ...
[2] Paragraph ... of act of ...
[3] Paragraph ... of act of ...
[4] Paragraph ... of act of ...
[5] Paragraph ... of act of ...
[6] Paragraph ... of act of ...
[7] Round wire, ... of ... inch in diameter.
[8] Galvanized fence.

The bulk of the imports, before the outbreak of the war, consisted
pecial grades of wire, as high-carbon steel wire for use in wire rope.
Destination in the United States.—In 1913 and 1914 approximately
per cent of the value of the imports of dutiable iron and steel
e and articles made from wire entered the country through the
toms districts of New York, Massachusetts, and Philadelphia,
proximately 40 per cent entered through the districts of Wash-
ton (State) and St. Louis, in each of which is located a plant of
e of the large wire-rope manufacturers of the United States. Other
tricts took 16 per cent. During the three following years the
ports fell off decidedly, and the proportion entered through the three
tern coast districts increased to 72 per cent in 1917. The two
tricts above mentioned took only 7 per cent and the remaining 21.
The wire imported into the United States is used in the making of
e rope, needles, hairpins, wire cloth and screen, electrical work,
okbinding, reinforcing window glass, for music wire, and other
rposes. The amount used for agricultural purposes is negligible.
Character.—Imports of iron and steel wire into the United States
re continuous prior to the war. Since they are confined to special
ades of wire, they do not come into competition with the industry
a whole, but with special branches of the industry, such as the
oduction of rope wire and needle wire. The decline of imports,
e to the war, has resulted in the substitution of domestic material
such uses, which has apparently not been detrimental to the
ality of the product.
The production of standard grades of iron and steel wire for ordinary
es is an industry independent of duties, selling its products in the
port markets of the world and even exporting to Great Britain.
e import of special wires rests upon their superiority to domestic,
ised by greater purity (absence of phosphorus and sulphur) in the
n or steel used. Such steel has been produced in the United
ates during the war in sufficient quantity to meet a doubled demand
wire rope. For the future the electric process gives promise of
onomical production of grades of steel of great freedom from
osphorus and sulphur. (See Survey on Iron and Steel Wire Rods.)
Revenue.—On the $2,250,194.11 worth of wire imported from July 1,
06, to August 5, 1909, under the act of 1897, $937,899.17 in duties
re collected, an amount equivalent to ad valorem rate of 42 per
nt. Under the act of 1909 (Aug. 6, 1909–Oct. 3, 1913) wire valued
$3,318,960.37 was imported, on which $1,254,290.33 in duties
re collected, equivalent to 38 per cent ad valorem. For the act
1913, from October 4, 1913, to June 30, 1917, these figures are
,289,854, $192,896.25, and 15[1] per cent.
The act of 1909 thus made a slight reduction in rate, and that of
13 a decided one. Because of the war, imports show a very great
crease since 1914, which has acted with the decreased rate to
crease revenue. Under the two previous acts, since July 1, 1906,
venue had varied from approximately $250,000 to approximately
50,000 per year. In 1915 it was $73,000; in 1916, $16,000; in
17, $7,000, and in 1918, $2,000.
Drawbacks previous to the war (1907–1914) averaged $21,000
nrly. They declined to $1,300 in 1917.

1.95. A small amount admitted free as baling wire and galvanized fencing wire.

TARIFF HISTORY.

Paragraph 114 of the act of 1913 laid a duty of 15 per cent round iron and steel wire, and such wire coated by dipping or g vanizing with zinc, tin, or other metal. Galvanized fence wire a baling wire were admitted free under paragraph 645. Imports such wire are negligible.

In the acts of 1883 and 1890 the duties on plain and galvani iron and steel wire were specific, graded according to the size of t wire. The duty on galvanized wire was that of plain wire plus o half cent per pound. The act of 1894 kept specific duties for w valued at 4 cents or less per pound, but provided for a 40 per ce ad valorem duty on that valued above 4 cents. The act of 18 kept the same rates as the preceding act, laying an additional duty two-tenths cent per pound on galvanized wire. The act of 19 substituted for the former provision of a specific rate on wire value at 4 cents or less per pound and an ad valorem rate on wire value over 4 cents per pound the provision that the specific rates shou not be levied when they amounted to less than 35 per cent ad valore but in place of them an ad valorem rate of 35 per cent.

COMPETITIVE CONDITIONS.

The imported wire does not come into competition with the ge eral product of the wire industry, but with wire of special quali produced for certain uses. The continued import of wire, and o wire rods to be drawn into wire, rests upon the reputed superio quality of the imported material, arising from the use of ores of grea purity and from processes in the making of the iron and steel which introduce fewer impurities than those used in the United States. Since the shutting off of imports during the war, domestic materials have been substituted, and the general opinion among wire-rope manufacturers and in the trade is that this substitution has taken place without detriment to the product. One manufacturer of wire rope, however, stopped making his best grade when unable to get the English wire he had formerly used.

Much of the imported material used for the manufacture of wire products in this country comes in in the form of rods which are drawn into wire for similar special uses. The advantage of the foreign wire thus does not seem to have arisen from the wire-drawing process. The production in the United States of iron or steel of a purity -freedom from phosphorus and sulphur—sufficient to make it suitable for the special uses to which the foreign material has been put is discussed in the catalogue on iron and steel wire rods.

Mr. H. Sanborn Smith, vice president of the Gulf States Steel Co., says relative to rope wire, which has formed such a large part of our imports: [1]

> We doubt very much whether the English rope-wire rod or English rope wire is in any way superior to the products now being made by the wire makers of the United States—indeed, in some cases we have known of the domestic product being unquestionably superior.
>
> Specialization in the manufacture of rope-wire rods and rope wire in England and Germany is of many years' standing and it is fair to acknowledge that it has taken American manufacturers some time to achieve the standard quality established by

[1] Letter of Jan. 10, 1919, to the commission.

foreign manufacturers, but we now know that this has been accomplished, as ave personally tested in every conceivable way time and time again samples of gn material along with that of our domestic manufacturers, and have found convely that the foreign wires are in no wise superior to those made by the manuers of this country.

n standard wire products the United States manufacturers sup- the domestic market and export to a large extent. The Iron Steel Wire Manufacturers' Association (British) stated that e manufacturing units with economical production have enabled erican manufacturers to drive British firms out of export markets standard products, such as barbed wire.[1]

he commissioner of corporations prepared figures for the cost of ducing bright coarse wire, 1902–1906. These figures may be taken indicative of costs up to the beginning of the war, for there were great fluctuations in price, 1907–1914, from those of the former iod.

COSTS.

Average book cost of bright coarse wire, per ton, by years, 1902–1906.[1]

Item.	1902	1903	1904	1905	1906	Total average.
Net tons produced	1,065,553	1,079,173	1,418,911	1,481,965	1,464,766	6,510,368
n rods	$24.50	$25.32	$23.04	$22.29	$23.11	$23.50
or	1.91	1.87	1.48	1.51	1.47	1.62
n	.52	.52	.37	.34	.32	.40
ning and coating	1.05	1.03	.87	.94	.92	.95
ther	4.32	2.67	2.26	2.13	2.29	2.65
Total	32.30	31.41	28.02	27.21	28.11	29.12

[1] Report of the U. S. Commissioner of Corporations on the Steel Industry, 1913, Part III, p. 247 (table leased).

DRAWBACK.

The drawbacks paid on imported iron and steel wire, and manufac- res thereof, were as follows:

7	$22,531.45	1913	$23,592.06
8	14,824.74	1914	15,636.71
9	21,585.29	1915	10,702.30
0	21,534.72	1916	4,093.65
1	26,565.14	1917	1,293.45
2	21,379.48	1918	347.61

The articles exported in which the foreign wire was used, and the awback paid, were as follows for 1913, 1914, and 1917:

	Drawback paid.
13:	
Steel wire in electrical machinery	$45.72
Wire manufactures in automobiles	12.67
Electric-light wire in passenger cars	143.75
Steel needle wire in needles	3,844.89
Steel wire in wire rope	19,186.39
Steel wire in pianos	85.25
Steel wire in other musical instruments	273.39
14:	
Wire manufactures in automobiles	1.58
Steel needle wire in needles	3,384.81
Steel wire in wire rope	12,183.13
Steel wire in pianos	67.19

[1] Iron and Coal Trades Review, June 14, 1918, p. 668.

	Drawback paid.
1917:	
Wire manufactures in automobiles	$209.24
Steel wire in wire rope	1,049.57
Steel wire in pianos	19.05
Steel wire in other musical instruments	15.59
1918:	
Steel wire in air-compressing machinery	.45
Steel wire in wire rope	342.31
Steel wire in pianos	4.85

Iron and steel wire produced in the United States.

[From Federal Census.]

Made by—	Quantity.			
	Plain wire.		Coated wire.	
	1909	1914	1909	1914
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Establishments purchasing wire rods	188,846	206,575	155,059	158,[illegible]
Wire departments of rolling mills and other concerns	283,200	253,334	199,346	215,[illegible]
Total quantity	472,046	459,909	354,405	374,[illegible]
	Value.			
Establishments purchasing wire rods	$11,349,868	$12,921,557	$7,473,167	$7,123,[illegible]
Wire departments of rolling mills and other concerns	11,282,362	9,395,221	8,739,684	8,826,[illegible]
Total value	22,632,230	22,316,778	16,212,851	15,949,[illegible]

Wire, and articles made from [1] *—Imports by countries (fiscal years).*

Imported from—	1910	1911	1912	1913	1914	1915
France	$93,182	$18,533	$90,031	$54,253	$74,209	$56,[illegible]
Germany	307,545	417,028	330,256	297,791	291,502	130,[illegible]
United Kingdom	978,375	945,460	684,108	794,357	841,289	681,[illegible]
Canada	1,133	3,372	6,292	6,653	21,874	23,[illegible]
Belgium	2,590	1,831	1,805	1,089	2,250	[illegible]
Sweden	19,024	129	50	4,998	12,794	12,[illegible]
All other	9,662	5,278	7,628	15,190	20,144	19,[illegible]
Total	1,382,811	1,421,643	1,090,170	1,174,331	1,264,062	925,[illegible]

	1916	1917	1918	1918 [2]	1919 [2]
Austria					[illegible]
France	$67,822	$67,063	$57,980	$39,055	73,[illegible]
Germany	18,390	2,642	477		14,[illegible]
Sweden	12,376	87,687	38,051	2,877	[illegible]
Switzerland	17,093	7,673	4,841	3,014	20,[illegible]
United Kingdom	338,177	251,436	101,754	122,893	155,[illegible]
Canada	56,043	56,092	92,404	103,214	145,[illegible]
All other	7,710	14,141	11,064	2,652	1,[illegible]
Total	548,121	487,934	309,571	273,705	463,[illegible]

[1] Plain and galvanized wire not specified. [2] Calendar year.

Wire, and articles made from—Imports by customs districts (fiscal years).

Imported at—	1910	1911	1912
ıtic coast	$636,029	$635,383	$569,670
oast	1,533	643	679
an border	6	7	136
ic coast	212,944	210,317	217,241
ern border	153,508	166,607	92,436
ior ports	378,891	408,681	210,008
Total	1,382,811	1,421,643	1,090,170

Wire, and articles made from—Imports by customs districts (fiscal years).

Imported at—	1913	1914	1915	1916	1917	1918
achusetts	[1] $50,550	$80,588	$72,069	$42,993	$46,767	$30,710
York	419,294	415,485	284,222	242,205	277,002	155,738
delphia	52,529	64,948	62,155	29,716	28,290	20,276
e Island	17,971	[2]	27,491	19,979	13,805	23,389
rancisco	19,219	[2]	1,874	1,547	198	75
ern California	[3] 49,314	[2]	18,919	10,353	2,488	19
ington	[4] 231,112	225,098	144,229	14,039	21,370	20,793
go	[2]	[2]	18,131	5,128	4,786	6,539
ouis	232,598	281,442	187,357	39,432	12,677	2,083
	[5] 43,585	51,273	61,655	119,973	43,585	
igan	[2]	[2]	3,633	4,038	12,604	8,463
ther	58,159	142,228	43,796	18,718	24,362	41,486
Total	1,174,331	1,264,062	925,531	548,121	487,934	309,571

[1] Boston and Charlestown.
[2] Included in all other.
[3] Los Angeles.
[4] Puget Sound.
[5] Cuyahoga.

Wire, and articles made from—Imports by customs districts (calendar years).

Imported at—	1918	1919
achusetts	$60,148	$36,410
York	66,868	179,044
delphia	13,634	41,222
e Island	27,449	35,684
ington	16,729	6,192
burgh	11	18,401
go	5,317	5,048
ouis	2,083	26,255
igan	8,139	30,889
lo	61,029	57,205
ther	12,298	26,704
Total	273,705	463,054

Wire, and articles made from—Imports by customs districts (fiscal years).

Imported at—	Percentage of total amount.					
	1913	1914	1915	1916	1917	1918
achusetts York delphia	44.48	44.38	45.21	57.45	72.15	66.72
ington	19.68	17.81	15.58	25.61	4.38	6.72
ouis	19.81	22.26	20.24	7.19	2.60	.67
districts	16.03	15.55	18.97	9.75	20.87	25.88
Total	100.00	100.00	100.00	100.00	100.00	100.00

Imports for consumption—Revenue.

WIRE: BALING WIRE.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914	Free	33,191	$779		$0.023	
1915	do	7,400	223		.030	
1916	do	5,800	221		.038	
1917	do	16,821	844		.050	
1918	do	5,200	347		.067	
1919	do	2,750	162		.059	
1920	do	377,234	23,561		.062	

BARBED WIRE.

		Pounds.				*Per cent.*
1910	¼ cent per pound	6,277	$605	$47	$0.096	7.77
1911	do	160	4	1	.025	30.00
1912	do	200	6	1	.032	23.44
1913	do					
1914	do	400	12	3	.030	25.00
	Free	147,500	3,616		.025	
1915	do	17,386	361		.021	
1916	do	493,819	13,262		.027	
1917	do	200	10		.050	
1918	do	133,473	3,256		.024	
1919	do	77,730	4,492		.057	
1920	do	12,911	610		.047	

Galvanized wire not larger than twenty one-hundredths inch in diameter and not smaller than eight one-hundredths in diameter, commonly used for fencing purposes.

		Pounds.				*Per cent.*
1914	Free	45,200	$962		$0.019	
1915	do	2,509	78		.031	
1916	do	26,285	823		.031	
1917	do	1,117	49		.044	
1918	do	787	67		.085	
1919	do	67,558	5,072		.075	
1920	do	644,786	29,800		.046	

ROUND IRON OR STEEL WIRE, ALL VALUED AT MORE THAN 4 CENTS PER POUND.

		Pounds.				*Per cent.*
1908	40 per cent	10,847,551	$594,478	$237,791	$0.055	40.00
1909	do	8,525,593	429,056	171,622	.050	40.00
1910	do	799,581	38,256	15,302	.048	40.00

ound iron or steel wire imports for consumption—Revenue—Continued.

:R ON WHICH THE SPECIFIC DUTY DOES NOT AMOUNT TO 35 PER CENT.

year:	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	35 per cent.....	6,807,096	$447,587	$156,655	$0.066	35.00
.....	.....do.....	7,056,716	384,268	134,493	.054	35.00
.....	.....do.....	4,502,573	329,721	115,402	.073	35.00
.....	.....do.....	6,284,842	480,928	168,324	.077	35.00
.....	.....do.....	1,307,929	88,699	31,044	.068	35.00
.....	15 per cent.....	12,241,113	616,486	92,472	.050	15.00
.....	.....do.....	10,218,413	480,103	72,015	.047	15.00
.....	.....do.....	1,697,073	106,259	15,938	.063	15.00
.....	.....do.....	420,270	41,844	6,276	.099	15.00
.....	.....do.....	47,059	12,260	1,839	.261	15.00
.....	.....do.....	56,803	42,171	6,326	.742	15.00
.....	.....do.....	3,397,614	263,672	39,551	.078	15.00

h, telephone, and other wires and cables composed of metal and rubber or of metal, rubber, and other materials.

		Pounds.				*Per cent.*
.....	40 per cent.....	127,241	$34,446	$13,778	$0.271	40.00
.....	.....do.....	50,711	6,143	2,457	.121	40.00
.....	.....do.....	52,059	11,030	4,412	.212	40.00
.....	.....do.....	34,205	4,448	1,779	.129	40.00
.....	.....do.....	2,425	299	119	.123	40.00
.....	15 per cent.....	.....	30,010	4,501	.....	15.00
.....	.....do.....	.....	43,362	6,504	.....	15.00
.....	.....do.....	.....	10,594	1,589	.....	15.00
.....	.....do.....	.....	8,577	1,286	.....	15.00
.....	.....do.....	.....	23,025	3,453	.....	15.00
.....	.....do.....	218,507	49,577	7,437	.227	15.00
.....	.....do.....	5,399	338	51	.064	15.00
.....	.....do.....	.....	.....	.....	.....	15.00

l steel wire, coated by dipping, galvanizing, or similar process with zinc, tin, or other metal.

ALL VALUED AT MORE THAN 4 CENTS PER POUND.

		Pounds.				*Per cent.*
.....	$\frac{1}{8}$ cent per pound plus 40 per cent.	122,500	$9,333	$3,978	$0.076	42.63
.....	.....do.....	136,234	14,226	5,962	.105	41.92
.....	.....do.....	20,297	1,897	799	.093	42.14

ON WHICH THE SPECIFIC DUTY DOES NOT AMOUNT TO 35 PER CENT.

.....	$\frac{1}{8}$ cent per pound plus 35 per cent.	322,227	$31,427	$11,643	$0.098	37.05
.....	.....do.....	270,558	31,284	11,490	.116	36.73
.....	.....do.....	148,342	19,310	7,055	.130	36.54
.....	.....do.....	101,895	9,625	3,572	.095	37.12
.....	.....do.....	11,278	813	307	.072	37.77
.....	15 per cent.....	.....	23,748	3,562	.....	15.00
.....	.....do.....	.....	6,518	977	.....	15.00
.....	.....do.....	.....	5,121	768	.....	15.00
.....	.....do.....	.....	5,896	884	.....	15.00
.....	.....do.....	.....	1,248	187	.....	15.00
.....	.....do.....	16,708	4,930	740	.295	15.00
.....	.....do.....	225,118	23,892	3,584	.106	15.00
.....	.....do.....	.....	.....	.....	.....	15.00

emitted under sec. 5, act of Aug. 24, 1912, on a value of $59.
emitted under sec. IV, J 5, act of 1913, on a value of $753.

Wire of iron or steel, covered with cotton, silk, or other material—Imports for con tion—Revenue.

HAT, BONNET, CRINOLINE, ETC., WIRE VALUED AT MORE THAN 4 CENTI POUND.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Acti con ad v r
		Pounds.				*Pe*
1908	45 per cent	740,079	$132,909	$59,909	$0.179	
1909	do	502,384	87,002	39,150	.173	
1910	do	51,665	8,204	3,691	.159	

COLD-ROLLED, COLD-HAMMERED, BLUED, ETC.

1908	1 cent per pound plus 45 per cent.	52,741	$11,708	$5,796	$0.222
1909	do	86	36	17	.419

COATED WITH TIN, ZINC, OR OTHER METAL.

1908	⅛ cent per pound plus 45 per cent.	2,576	$3,856	$1,740	$1.496
1909	do	80	6	2	.075
1910	35 per cent	318,780	56,187	19,665	.176
1911	do	20,618	5,380	1,883	.261
1912	do	95,417	21,014	7,354	.220
1913	45 per cent [1]	6,933	1,548	698	.223
1914	15 per cent	447,459	20,881	3,132	.047
1915	do	5,108	1,667	280	.326
1916	do	5,466	828	124	.151
1917	do	47,644	3,182	477	.067
1918	do		1,582	237	
1919	do	58,070	26,606	3,991	.458
1920	do	32,716	6,162	924	.188
1921	do				

All other wire, n. s. p. f.

						Pe
		Pounds.				
1910	35 per cent	589,139	$76,439	$26,803	$0.130	
1911	do	1,608,463	281,112	98,389	.175	
1912	do	643,943	86,495	30,273	.134	
1913	45 per cent [1]	50,791	13,841	6,223	.244	
1914 [2]	do	1,200	200	90	.167	
	15 per cent		80,068	12,010		
1915	do		85,564	12,834		
1916	do		60,323	9,048		
1917	do		52,742	7,911		
1918	do		61,752	9,262		
1919	do	275,885	56,435	8,465	.205	
1920	do	2,250,041	154,465	23,170	.069	
1921	do					

[1] Treasury Decision 32600.
[2] Duty remitted under Sec. IV., J 5, act of 1913, on a value of $25.

Imports for consumption—Revenue.

ROUND IRON OR STEEL WIRE.

al year.	Size and rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
	Not smaller than No. 13 wire gauge:	*Pounds.*				*Per cent.*
	1¼ cents per pound.	1,290,415	$43,581	$16,130	$0.034	37.01
	Do	1,157,999	38,060	14,474	.033	38.03
	Do	230,858	7,328	2,885	.032	39.38
	1 cent per pound.	920,076	25,238	9,200	.027	36.46
	Do	723,006	19,634	7,230	.027	36.82
	Do	711,229	18,767	7,112	.026	37.90
	Do	581,468	15,541	5,814	.027	37.42
	Do	16,338	469	163	.029	34.84
	Smaller than No. 13 and not smaller than No. 16 wire gauge:					
	1¼ cents per pound.	1,991,281	67,388	29,869	.034	44.33
	Do	2,552,934	86,926	38,294	.034	44.05
	Do	308,465	7,999	4,551	.026	56.90
	1½ cents per pound.	2,900,683	91,377	36,258	.031	39.68
	Do	3,666,897	117,083	45,836	.032	39.15
	Do	2,704,308	85,515	33,803	.032	39.53
	Do	2,531,745	80,304	31,646	.032	39.41
	Do	326,142	10,145	4,076	.031	40.19
	Smaller than No. 16 wire gauge:					
	2 cents per pound.	1,407,795	52,007	28,155	.037	54.12
	Do	1,702,724	62,063	34,054	.036	54.87
	Do	212,457	6,899	4,249	.032	61.59
	2½ cents per pound.	6,046,793	246,884	105,818	.041	42.86
	Do	7,470,974	312,626	130,742	.042	41.82
	Do	4,730,229	194,690	82,779	.041	42.52
	Do	4,690,913	199,267	82,091	.042	41.20
	Do	1,440,602	63,601	25,210	.044	39.64

) IRON OR STEEL WIRE, COATED WITH ZINC OR TIN OR ANY OTHER METAL.

	Not smaller than No. 13 wire gauge:	*Pounds.*				*Per cent.*
	1⅜ cents per pound.	36,804	$1,415	$633	$0.038	37.71
	Do	46,714	1,669	677	.034	42.63
	1⅜ cents per pound.	32,519	832	300	.026	46.90
	Do	16,350	466	196	.029	42.10
	Do					
	Do	40,151	1,224	481	.030	39.36
	Do	2,436	61	29	.025	47.92
	Smaller than No. 13 and not smaller than No. 16 wire gauge:					
	1⅞ cents per pound.	62,522	2,344	1,062	.037	45.34
	Do	4,537	200	77	.044	38.67
	1⅞ cents per pound.	9,508	367	137	.038	37.86
	Do	23,310	863	337	.037	39.16
	Do	4,648	151	67	.032	44.64
	Do	1,063	60	15	.057	25.45
	Do					
	Smaller than No. 16 wire gauge:					
	2⅜ cents per pound.	18,568	$718	$408	$0.039	56.90
	Do	19,925	3,601	438	.181	12.17
	1⅝ cents per pound.	42,966	1,908	837	.044	43.91
	Do	37,292	1,336	727	.041	47.34
	Do	62,340	2,349	1,215	.038	51.75
	Do	81,683	3,379	1,592	.041	47.41
	Do	24,874	897	485	.036	54.07

remitted under sec. IV, J. 5, act of 1913, on a value of $34.

Wire: All other (except barbed)—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	3,147,628	$112,539	7,560,808	$210,339	5,472,656	$150,9[illegible]
Canada	59,900,972	1,296,835	70,185,252	1,483,075	87,276,303	1,720,5[illegible]
Mexico	9,577,136	266,070	9,340,114	253,108	9,503,689	240,4[illegible]
Argentina	27,244,112	570,262	40,432,745	863,558	56,174,442	1,106,8[illegible]
Australia	39,718,028	819,834	58,641,232	1,228,382	63,898,920	1,259,6[illegible]
New Zealand	8,962,363	197,255	10,380,797	231,648	15,244,524	306,2[illegible]
Brazil	854,812	25,465	572,563	15,564	3,435,549	92,1[illegible]
France	74,070	1,708	82,670	1,819	44,087	9[illegible]
Russia	97,822	3,681	39,526	1,208	38,695	9[illegible]
All other	31,811,488	781,006	57,038,427	1,267,786	74,698,563	1,611,7[illegible]
Total	181,388,431	4,074,655	254,274,134	5,556,577	315,787,428	6,911,[illegible]

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	7,202,532	$195,220	5,319,864	$157,977	28,059,182	$611,9[illegible]
Canada	98,637,528	1,912,069	74,873,017	1,476,297	84,638,637	1,611,6[illegible]
Mexico	7,894,927	212,079	4,114,971	96,063	1,666,538	43,1[illegible]
Argentina	49,409,155	976,694	19,302,865	359,446	39,871,153	798,7[illegible]
Australia	69,811,745	1,315,565	44,264,940	835,363	58,205,731	1,208,4[illegible]
New Zealand	11,691,055	207,236	9,043,327	165,825	10,104,185	178,3[illegible]
Brazil	4,360,217	107,502	1,449,046	29,761	7,783,867	156,3[illegible]
France	25,110	702			13,505,441	324,5[illegible]
Russia	51,044	1,051	50,350	1,085	7,320,514	139,3[illegible]
All other	59,577,659	1,270,844	30,453,864	657,744	76,030,908	1,572,8[illegible]
Total	308,660,972	6,198,962	188,872,244	3,799,561	327,186,136	6,948,9[illegible]

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	51,908,702	$1,387,549	30,719,267	$1,277,515	19,035,048	$949,9[illegible]
Canada	86,321,987	2,312,725	63,139,222	2,285,206	60,789,852	2,916,3[illegible]
Mexico	2,942,007	102,916	2,720,017	146,881	2,988,341	216,6[illegible]
Argentina	88,519,483	2,362,301	62,603,695	2,603,261	44,999,850	2,514,9[illegible]
Australia	45,613,448	1,112,531	21,197,184	795,663	31,713,205	1,699,0[illegible]
New Zealand	10,716,320	262,432	4,549,437	160,663	5,964,981	311,4[illegible]
Brazil	20,800,446	605,373	26,480,091	1,253,171	19,900,768	1,158,7[illegible]
France	70,907,245	2,227,414	135,626,798	5,154,955	21,744,921	1,141,1[illegible]
Russia	49,320,354	1,448,330	24,252,074	1,080,699	2,783,494	169,8[illegible]
All other	137,006,874	4,254,961	171,053,985	7,991,533	167,632,170	10,098,4[illegible]
Total	564,056,866	16,076,532	542,341,770	22,749,457	377,552,610	22,043,7[illegible]

Wire, all other (except barbed)—Domestic exports (calendar years).

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
France	61,795,530	$3,191,024	5,959,876	$327,2[illegible]
Norway	5,937,252	328,305	8,761,480	484,9[illegible]
Portugal	11,106,160	611,225	6,281,369	355,2[illegible]
England	4,932,370	255,957	11,403,630	628,7[illegible]
Canada	52,316,902	2,787,051	47,539,523	2,[illegible]
Mexico	2,454,019	165,960	4,571,910	325,9[illegible]
Cuba	2,959,339	271,948	6,752,732	469,3[illegible]
Argentina	36,379,876	2,305,389	103,535,977	5,[illegible]
Brazil	11,260,831	745,945	34,031,528	2,[illegible]
Chile	7,772,061	491,030	10,017,002	567,1[illegible]
Uruguay	3,099,228	216,134	19,407,106	1,[illegible]
China	11,451,221	748,133	15,171,044	786,4[illegible]
British India	8,195,931	554,589	6,350,019	418,[illegible]
Dutch East Indies	3,009,940	221,858	4,457,313	329,4[illegible]
Japan	67,450,924	4,328,984	59,582,379	3,[illegible]
Australia	19,803,607	1,177,848	34,029,111	1,[illegible]
New Zealand	2,566,369	151,322	10,660,450	594,[illegible]
British South Africa	2,395,383	135,521	12,212,638	737,[illegible]
All other	37,290,811	2,016,120	24,848,990	1,[illegible]
Total	352,177,754	20,704,503	426,074,277	24,[illegible]

Plain and galvanized round wire—Prices, Pittsburgh, per 100 pounds.

[Metal Statistics, 1918, p. 101.]

Year.	Kind or grade.		
	Plain.		Galvanized.
	High.	Low.	
.....	$3.05	$2.15	
.....	2.25	1.85	
.....	2.00	1.75	
.....	1.90	1.75	
.....	1.85	1.45	
.....	1.65	1.60	
.....	1.85	1.65	
.....	1.90	1.85	
.....	1.90	1.80	
.....	1.80	1.40	
.....	1.65	1.50	Plain plus 30 cents.
.....	1.60	1.30	Do.
.....	1.55	1.35	Plain plus 30 cents (before Oct. 12). Plain plus 40 cents (Oct. 12 and after).
.....	1.60	1.30	Plain plus 40 cents.
.....	1.40	1.30	Do.
.....	1.95	1.30	Plain plus 40 cents (before Mar. 1). Plain plus 50 cents (Mar. 1 and after). Plain plus 60 cents (Mar. 17 amd after). Plain plus 80 cents (June 1 and after). Plain plus 60 cents (Aug. 16 and after). Plain plus 70 cents (Aug. 23 and after).
.....	2.95	1.95	Plain plus 70 cents.
.....	3.95	2.95	Do.
.....	[1] 3.25	3.25	
.....	3.25	3.00	

[1] rnment price, Nov. 6, 1917–Dec. 31, 1918.

—Weekly and monthly prices are given in the Iron Trade Review; daily in the American Metal and Daily Iron and Steel Report.

Court and Treasury Decisions.

re has been defined as "a slender rod, strand, or thread, of ductile ," usually formed by drawing through vise or holes, though rly made by hammering. Coiled wire having a use as a spring ing from the changed form into which the original wire was anently converted was held dutiable as a manufacture of wire paragraph 135 of the act of 1909 rather than as wire under raph 135. (Boye Needle Co. *v.* United States, 5 Ct. Cust. . 43; Tyler Co. *v.* United States, 6 Ct. Cust. Appls. 158.)

importation commercially known as "ribbon wire," not in fact ad steel wire, but flat strips of woven cotton metal about one- inch in width and containing three round steel wires, was held ble under paragraph 135 of the act of 1909 as a manufacture of steel wire covered with cotton. (Steinhardt *v.* United States, Cust. Appls. 420.)

isions under the act of 1897 led to modifications in the law as d in the act of 1909.

American wire gauge (Brown & Sharpe) is used when applicable termining diameters under paragraph 114 of the act of 1913. . 34701.)

Iron and steel wire, plain and coated—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, s and ad valor
1883	182	Iron or steel wire:	
		Smaller than No. 5 and not smaller than No. 10 wire gauge...	1½ cents per pou
		Smaller than No. 10 and not smaller than No. 16 wire gauge..	2 cents per pou
		Smaller than No. 16 and not smaller than No. 26 wire gauge..	2½ cents per pou
		Smaller than No. 26 wire gauge.....	3 cents per pou
		Provided, That iron or steel wire covered with cotton, silk, or other material, and wire commonly known as crinoline, corset, and hat wire, shall pay 4 cents per pound in addition to the foregoing rates: *And provided further*, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made, either wholly or in part: *And provided further*, That iron or steel wire-cloths, and iron or steel wire nettings, made in meshes of any form, shall pay a duty equal in amount to that imposed on iron or steel wire of the same gauge, and 2 cents per pound in addition thereto. There shall be paid on galvanized iron or steel wire (except fence wire), ½ cent per pound in addition to the rate imposed on the wire of which it is made.	
1890	148	Wire:	
		Wire made of iron or steel, not smaller than No. 10 wire gauge.	1½ cents per pou
		Smaller than No. 10 and not smaller than No. 16 wire gauge.	1¾ cents per pou
		Smaller than No. 16 and not smaller than No. 26 wire gauge.	2½ cents per pou
		Smaller than No. 26 wire gauge.....	3 cents per pou
		Provided, That iron or steel wire covered with cotton, silk, or other material, and wires or strip steel, commonly known as crinoline wire, corset wire, and hat wire, shall pay a duty of 5 cents per pound: *And provided further*, That flat steel wire, or sheet steel in strips, whether drawn through dies or rolls, untempered or tempered, of whatsoever width, twenty-five one-thousandths of an inch thick or thinner (ready for use or otherwise), shall pay a duty of 50 per cent ad valorem: *And provided further*, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made either wholly or in part: *And provided further*, That iron or steel wire cloths, and iron or steel wire nettings made in meshes of any form, shall pay a duty equal in amount to that imposed on iron or steel wire used in the manufacture of iron or steel wire cloths or iron or steel wire nettings, and 2 cents per pound in addition thereto.	
1894	121	Wire:	
		Round iron or steel wire, all sizes not smaller than No. 13 wire gauge.	1¼ cents per pou
		Smaller than No. 13 wire gauge and not smaller than No. 16 wire gauge.	1½ cents per pou
		Smaller than No. 16 wire gauge.....	2 cents per pou
		All other iron or steel wire and wire or strip steel, commonly known as crinoline wire, corset wire, drill rods, needle wire, piano wire, clock and watch wire, and all steel wires, whether polished or unpolished, in coils or straightened, and cut to lengths, drawn cold through dies, and hat wire, flat steel wire, or sheet steel in strips, uncovered or covered with cotton, silk, or other material, or metal, and all the foregoing manufactures of iron or steel, of whatever shape or form, valued above 4 cents per pound, shall pay a duty of.	40 per cent ad v
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
1897	137	Round iron or steel wire:	
		Not smaller than No. 13 wire gauge.....	1¼ cents per pou
		Smaller than No. 13 and not smaller than No. 16 wire gauge..	1½ cents per pou
		Smaller than No. 16 wire gauge.....	2 cents per pou
		Provided, That all the foregoing valued at more than 4 cents per pound shall pay.	40 per cent ad v
		Iron or steel or other wire not specially provided for in this act, including such as is commonly known as hat wire, or bonnet wire, crinoline wire, corset wire, needle wire, piano wire, clock wire, and watch wire, whether flat or otherwise, and corset clasps, corset steels and dress steels, and sheet steel in strips, twenty-five one-thousandths of an inch thick or thinner: Any of the foregoing, whether uncovered or covered with cotton, silk, metal, or other material, valued at more than 4 cents per pound.	45 per cent ad v

Iron and steel wire, plain and coated—Rates of duty—Continued.

ct	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
		Provided, That articles manufactured from iron, steel, brass, or copper wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1½ cents per pound, except that wire rope and wire strand shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture thereof, and in addition thereto 1 cent per pound; and on iron or steel wire coated with zinc, tin, or any other metal, two-tenths of 1 cent per pound in addition to the rate imposed on the wire of which it is made.	
909	135	Round iron or steel wire:	
		Not smaller than No. 13 wire gauge	1 cent per pound.
		Smaller than No. 13 and not smaller than No. 16 wire gauge	1½ cents per pound.
		Smaller than No. 16 wire gauge	1½ cents per pound.
		Provided, That all the foregoing shall pay duty at not less than—	35 per cent ad valorem.
		All wire composed of iron, steel, or other metal except gold or silver, covered with cotton, silk, or other material, corset clasps, corset steels, dress steels, and all flat wires, and steel in strips, not thicker than No. 15 wire gauge and not exceeding 5 inches in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls, or otherwise produced, and all other wire not specially provided for in this section, shall pay a duty of not less than 35 per cent ad valorem; on iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin, or other metal, there shall be paid two-tenths of one cent per pound in addition to the rate imposed on the wire of which it is made.	
		Provided further, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound: *And provided further*, That no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem; telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials, 40 per cent ad valorem; barbed fence wire, three-fourths of 1 cent per pound, but the same shall not be subject to any additional or other rate of duty hereinbefore provided; wire heddles or healds, 25 cents per 1,000, and in addition thereto, 40 per cent ad valorem.	
913	114	Round iron or steel wire; wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material; corset clasps, corset steels, dress steels, and all flat wires and steel in strips not thicker than No. 15 wire gauge and not exceeding 5 inches in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls, or otherwise produced; telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials; iron and steel wire coated by dipping, galvanizing, or similar process with zinc, tin, or other metal; all other wire not specially provided for in this section and articles manufactured wholly or in chief value of any wire or wires provided for in this section; all the foregoing.	15 per cent ad valorem.
		Wire heddles and healds	25 per cent advalorem.
		Wire rope	30 per cent advalorem.
	645	All barbed wire, galvanized wire not larger than twenty one-hundredths of 1 inch in diameter and not smaller than eight one-hundredths of 1 inch in diameter of the kind commonly used for fencing purposes, galvanized wire fencing composed of wires not larger than twenty one-hundredths of 1 inch in diameter not smaller than eight one-hundredths of 1 inch in diameter, and wire commonly used for baling hay or other commodities.	Free.

BARBED WIRE.

SUMMARY.

Barbed wire was put on the free list by the act of 1913. About one-quarter of the production is normally exported (26 per cent in 1914). Imports have been irregular, and in small amounts, without importance.

Barbed wire—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production (per cent).		Value (imports for consumption).[2]	Amount of duty.[2]	Value per pound.	Actual or equivalent ad valorem rate.
				Imports.	Exports.				
	Short tons.	*Short tons.*	*Short tons.*						*Per cent.*
1909	323,565								
1910		3.14	84,023	0.001	[3] 25.97	$605.17	$47.08	$0.096	7.77
1911		.08	92,906			4.00	1.20	.025	30.00
1912		.10	115,473			6.40	1.50	.032	23.44
1913			98,031						
1914	343,693	73.95	89,348	.002	26.00	3,628.00	3.00	.042	.083
1915		8.69	165,303			361.00		.021	
1916		246.91	407,952			13,262.00		.027	
1917		.10	339,627			10.00		.05	
1918		66.74	208,260			3,256.00		.024	
1919		38.87	221,029			4,492.00		.058	
1920		6.46	233,134			610.00		.047	

[1] Calendar years.
[2] Fiscal years ending June 30.
[3] Ratio of 1909 production to 1910 imports and exports.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 645. All barbed wire, galvanized wire not larger than twenty one-hundredths of one inch in diameter and not smaller than eight one-hundredths of one inch in diameter of the kind commonly used for fencing purposes, galvanized wire fencing composed of wires not larger than twenty one-hundredths of one inch in diameter nor smaller than eight one-hundredths of one inch in diameter, * * *, free.

DESCRIPTION.

Kinds. The various kinds of barbed wire differ in the kind of barbs and the method by which they are attached. The fencing may be made of galvanized wire, or of plain wire, finished, by painting. There is little commercial demand for wire of the latter finish, which has been used extensively for military purposes.

Uses.—The ordinary use of barbed wire is for farm fencing. Here comes into competition with other forms of fencing, especially oven wire. Its use as an instrument of war has caused an increase its manufacture, and the shipping of large quantities to Europe nich formerly imported little from the United States.

Despite its obvious disadvantages, the use of barbed wire does not em to be decreasing. It makes a light strong fence which is cheap id effective in turning cattle. It is used most extensively in the miarid regions of the West, where the system of farming does not mand a better fence in face of the greater cheapness of barbed ire. Only a change in the system of farming would displace it.

Woven wire, the use of which is increasing, has some disadvantages. does not wear well; the breaking of a single strand may result in hole which cattle will rapidly enlarge. The fence can not be as asily taken down, moved, and put up again as barbed wire can Where hogs are raised, low woven wire is frequently put up with aree or four strands of barbed wire at the top. One strand of arbed wire is almost invariably stretched at the top of a high oven-wire fence. The barbed-wire fence has been used very idely, but is falling into disfavor, and is being supplanted by the oven-wire fence.

DOMESTIC PRODUCTION.

Quantity.—In 1909 the production of barbed wire by wire-drawing stablishments was 323,565 [1] short tons, valued at $13,881,517.[1] In 914 the amount was larger—343,693 short tons—and the value ss—$13,764,367.

The capacity of the country is considered about 50,000 tons per onth; the normal output about 30,000. War requirements have aised the latter to 40,000, and an increase to 60,000 was contem- lated by the director of steel supplies.[2]

Methods and processes.—One form of barbed-wire machine makes e wire from three strands of round wire. One of these it cuts at a ng diagonal to the proper length to form the barbs. These barbs he machine twists about one of the wires at intervals of approxi- ately 6 inches. The two wires—one smooth, the other with barbs ttached—are then wound upon a reel having two motions, one twist- g the two wires about each other, the other winding the finished arbed wire upon the reel.

The demand for barbed wire is seasonal, very little fence being built n the winter and much in the spring.

Materials and equipment.—The raw material for the manufacture of arbed wire is steel wire of from 0.105 to 0.082 inch in diameter (12 to 4 wire gauge), galvanized if for the production of galvanized barbed ire.

Organization and capitalization.—Barbed wire is one of the many roducts of the wire industry. This is an industry of large establish- ents and corporate ownership. (See Survey on round iron and teel wire.) Of the products of the wire industry,[3] barbed wire

[1] A small amount of barbed wire, not made in wire-drawing establishments, not included in this total.
[2] Auxiliary file, clippings from the American Metal Market and Daily Iron and Steel Report, 1918.
[3] Plain wire; coated wire; wire nails and spikes; wire brads, tacks, and staples; barbed wire; wire rope nd strand; woven-wire fence and poultry netting; other woven-wire products; other fabricated iron and eel wire products.

shows the largest portion produced in rolling mills—in 1914, 274,461 tons were so produced, and 69,232 tons were produced by establishments buying their rods. The first forms 79.86 per cent of the total product.

Localities of production.—In 1914, 8 mills producing barbed wire were located in Pennsylvania, 7 in Illinois, 4 in Ohio, 4 in Indiana, and 1 each in Colorado, Georgia, Kentucky, Massachusetts, and Wisconsin. The distribution of the plants is thus influenced by the availability of raw materials and, in some instances, proximity to the demand arising from the western farming areas.

Domestic consumption.—The domestic consumption in 1914 may be estimated by adding to the production of that year imports for consumption for the calendar year and subtracting domestic exports. This calculation gives 343,693 tons plus 34 tons minus 105,078 tons equals 238,649 tons; $13,764,367 plus $1,653 minus $4,633,348 equals $9,132,672. This calculation is merely an estimate, for it does not take into account goods in warehouses.

In that year the total consumption in the United States thus equaled 69.4 per cent of the amount produced and 66.35 per cent of its value.

Exports.—In 1914 domestic exports amounted to 89,348 tons, valued at $4,039,590. The countries importing the largest amounts of barbed wire from the United States at that time were Canada, Brazil, British South Africa, Argentina, Cuba, Colombia, and Mexico. After the beginning of the war in Europe exports were larger. They amounted to 407,952 tons in 1916, 339,627 in 1917, and 208,260 in 1918. The largest export—that of 1916—is thus 64,259 tons greater than the 1914 production.

This great increase in exports went mostly to Russia in Europe and Asia.

History.—The barbed-wire fence machine was invented in 1873 by J. F. Glidden. This fence was well adapted to the needs of the western farmer during the expansion into the West and it soon became a staple commodity.

IMPORTS.

Quantity.—Imports have been specified only since 1910. For the four fiscal years 1910 to 1913 they averaged 0.83 ton per year, there being no imports during the last year of this period. In 1914 imports were 73.95 tons; in 1915, 8.69; and in 1916, 246.91. In the two following years they were less—0.10 and 66.74 tons, respectively. In 1920 imports were 6.46 tons.

The greatest import—that of 1916—was only an extremely small and insignificant fraction of the total available supply.
production in 1914.

Character.—Imports of barbed wire have thus been sporadic, in small amounts, and have no significance in competition with the American product.

Revenue.—The revenue derived from the duty on barbed wire under the act of 1909 amounted in all to only $52.78.

PRICES.

1 1910 the price of painted barbed wire per 100 pounds at Pitts-gh was between $1.70 and $1.85; that of galvanized between $2 $2.15. Lowest prices were reached in 1914, at $1.50 to $1.60 and 0 to $2, respectively. After the outbreak of the war prices rose l final adjustment at $3.65 for painted barbed wire. The price galvanized barbed wire is $4.35 per hundred pounds.

TARIFF HISTORY.

arbed wire is admitted free under paragraph 645 of the act of 1913. ad been first specified in the act of 1909, which laid a duty of three-ths cent per pound upon it.

EFFECTS OF THE WAR.

he average of the exports of barbed wire for the two years ing June 30, 1914, was 93,689 tons per year, or $4,269,549. ing the fiscal year 191[illegible], 16[illegible],303 tons were exported, valued at 16,389; in 1916, 407,9[illegible]2 tons, valued at $23,909,209. In 1917 amount exported dropped to 339,627 tons, valued, however, at ,10[illegible],496. This expansion has been absorbed by the nations at . Europe and Russia in Asia, which imported from the United tes during the years 1913 and 1914 an average of 2,492 tons per r, took 91,417 tons in 1915 and 320,372 tons in 1916. The orts of European countries not engaged in war decreased from average of 1,070 tons per year for the two years 1913 and 1914 16 tons in 1915 and 131 tons in 1916. From 1912 to 1917, the ort to countries outside of Europe and Russia in Asia decreased ewhat.

he following tables have been prepared to present these figures:

Fiscal year.	United States exports of barbed wire to—		Fiscal year.	United States exports of barbed wire to—	
	Europe and Russia in Asia.	All other countries.		Europe and Russia in Asia.	All other countries.
1912.			1915.		
nt (tons)	3,068	112,404	Amount (tons)	91,417	73,886
(dollars)	139,611	5,329,787	Value (dollars)	4,219,555	3,196,834
1913.			1916.		
nt (tons)	2,191	95,840	Amount (tons)	320,372	87,580
(dollars)	98,237	4,401,271	Value (dollars)	18,655,910	5,253,299
1914.			1917.		
nt (tons)	2,793	86,556	Amount (tons)	262,340	77,287
(dollars)	123,966	3,915,624	Value (dollars)	18,821,017	6,284,479

Fiscal year.	United States exports of barbed wire to— Denmark, Netherlands, Norway, Spain, Sweden, Iceland and Faroe Islands, Switzerland.	Belgium, Bulgaria, Finland, France, Gibraltar, Greece, United Kingdom, Italy, Portugal, Russia in Europe, Turkey in Europe.	Total, Europe.
1912.			
Amount (tons)	1,310	1,758	3,068
Value (dollars)	59,136	80,475	139,611
1913.			
Amount (tons)	854	1,337	2,191
Value (dollars)	38,520	59,717	98,237
1914.			
Amount (tons)	1,287	1,506	2,793
Value (dollars)	58,634	65,332	123,966
1915.			
Amount (tons)	316	67,796	68,112
Value (dollars)	12,647	3,113,252	3,125,899
1916.			
Amount (tons)	131	254,834	254,965
Value (dollars)	8,274	14,815,481	14,823,755
1917.			
Amount (tons)	31	207,903	207,934
Value (dollars)	3,782	15,231,561	15,235,343

Barbed wire—Production in United States.

[From Federal Census.]

	Quantity.	Value.
Calendar year:	*Tons.*	
1909	323,565	$13,881,817
1914	343,693	12,764,287

All barbed wire, etc.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.			*Dollars.*	*Per cent.*
1910	¼ cent per pound	6,277	$605	$47	0.096	7.77
1911	do	160	4	1	.025	20.69
1912	do	200	6	1	.032	23.44
1913	do					
1914[1]	do	400	12	3	.030	25.70
1914[2]	Free	147,500	3,616		.025	
1915	do	17,386	361		.021	
1916	do	493,819	13,262		.027	
1917	do	200	10		.050	
1918	do	133,473	3,256		.024	
1919	do	77,730	4,492		.058	
1920	do	12,911	610		.047	

[1] July 1 to Oct. 3, 1913, under act of 1909.
[2] Oct. 4, 1913 to June 30, 1914, under act of 1913.

Barbed wire—Domestic exports.

FISCAL YEARS.

orted to—	1910		1911		1912	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
.....	36,405,033	$839,818	32,364,055	$707,893	42,995,916	$895,725
.....	13,960,059	378,917	21,903,119	578,745	29,388,771	743,136
uth Africa....	17,422,157	476,031	17,106,101	463,903	25,881,351	618,837
.....	19,865,522	493,277	18,200,282	459,457	20,440,624	501,636
.....	20,999,266	609,732	19,208,861	524,459	15,587,204	415,179
.....	14,750,168	355,848	17,285,613	396,659	15,529,254	328,472
.....	5,712,648	152,877	6,917,659	170,773	9,837,078	226,619
.....						
.....						
.....	18,198	451				
.....	38,912,974	1,017,360	52,825,870	1,341,502	71,284,951	1,739,794
al.....	168,046,025	4,322,311	185,811,560	4,643,391	230,945,149	5,469,398

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
.....	32,188,156	$656,185	25,377,898	$508,337	30,055,855	$603,083
.....	32,735,774	794,825	26,926,909	618,399	23,913,387	538,800
uth Africa....	29,507,082	659,190	27,465,562	657,900	8,861,701	184,435
.....	14,135,069	321,893	13,413,340	309,571	15,645,095	343,008
.....	14,902,769	381,401	4,947,765	117,569	1,535,115	37,952
.....	12,708,264	268,850	14,714,562	313,753	15,259,328	313,484
.....	10,263,984	233,594	11,291,791	245,867	10,476,652	223,382
.....					60,695,786	1,470,471
.....					2,000	44
.....					87,059,458	2,017,108
.....	49,621,705	1,183,570	54,558,909	1,269,104	77,100,861	1,684,622
al.....	196,062,803	4,499,508	178,696,736	4,039,590	330,605,238	7,416,389

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
.....	43,572,371	$1,362,125	42,461,968	$1,528,745	36,615,513	$1,712,697
.....	33,388,221	1,063,655	27,774,674	1,299,428	24,657,515	1,284,064
uth Africa....	3,393,694	99,499	1,871,052	86,509	5,044,055	266,883
.....	19,339,560	581,054	15,741,178	697,910	17,163,361	932,286
.....	1,436,843	48,132	1,582,075	72,644	2,434,921	131,162
.....	16,679,539	456,013	17,434,331	711,832	13,431,179	661,694
.....	6,782,875	204,069	6,231,345	274,323	2,901,840	157,212
.....	131,382,554	4,024,596	198,483,272	6,976,536	79,247,197	3,046,553
.....	19,584,516	464,016	128,094,000	4,982,802	169,836,805	8,185,763
.....	460,278,708	13,105,795	187,514,327	6,438,910	[1] 21,593,503	[1] 1,067,599
.....	80,065,889	2,500,255	52,065,913	2,035,857	43,594,822	2,079,604
al.....	815,904,770	23,909,209	679,254,135	25,105,496	416,520,711	19,525,517

[1] o Russia in Asia.

Barbed wire—Domestic exports—Continued.

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.	Value.	Pounds.	Valu
France	253,725,831	$9,949,773	134,200	$
Italy	164,064,552	8,330,591	111	
Canada	22,843,073	1,081,182	49,583,580	2,178
Mexico	2,046,064	117,195	4,464,659	227
Cuba	5,614,497	289,015	29,652,190	1,393
Dominican Republic	1,707,584	107,976	2,376,997	126
Argentina	7,354,259	411,398	28,975,641	1,69
Brazil	6,650,301	388,211	58,769,093	3,251
Chile	946,358	52,960	2,936,172	158
Colombia	1,912,727	112,476	11,747,341	672
Uruguay	348,979	19,653	2,425,143	137
Venezuela	287,825	16,079	2,852,204	148
British India	1,829,030	100,484	1,188,526	68
Dutch East Indies	333,920	17,941	679,583	38
Japan	458,627	22,536	845,068	39
Australia	1,026,160	56,805	3,738,200	194
New Zealand	990,380	57,984	2,482,771	138
Philippines	643,492	32,274	2,892,706	147
British South Africa	1,319,042	74,241	8,149,142	379
Portuguese Africa	34,560	1,808	1,257,658	55
All other	52,449,111	2,699,236	12,098,997	628
Total	526,586,382	23,492,540	227,260,062	11,364

Barbed wire—Prices, wholesale, Pittsburgh, per 100 pounds.

[From Metal Statistics, 1921, p. 111.]

Year.	Painted.		Galvanized.	
	High.	Low.	High.	Low
1910	$1.85	$1.70	$2.15	$
1911	1.80	1.50	2.10	
1912	1.75	1.55	2.15	
1913	1.80	1.50	2.20	
1914	1.60	1.50	2.00	
1915	2.25	1.50	2.95	
1916	3.15	2.25	3.85	
1917	4.15	3.15	4.85	
1918	3.65	3.65	4.35	
1919	3.65	3.40	4.35	
1920	4.45	3.40	5.10	

Adjusted price, Nov. 5, 1917, painted, $3.65; galvanized, $4.35. 1918 adjusted price as above.
Weekly prices are given in the Iron Trade Review and the Iron Age; daily in the American Metal Ma and Daily Iron and Steel Report

Barbed wire—Rates of duty.

Act of— Year.	Par.	Tariff classification or description.	Rates of duty, spec and ad valorem.
1883		As wire	
1894		do	
1894		do	
1897		do	
1909	135	Barbed fence wire	¼ cents per pound.
		But the same shall not be subject to any additional or other rate of duty hereinbefore provided.	
1913	645	All barbed wire, galvanized wire not larger than twenty one-hundredths of 1 inch in diameter and not smaller than eight one-hundredths of 1 inch in diameter of the kind commonly used for fencing purposes, galvanized wire fencing composed of wires not larger than twenty one-hundredths of 1 inch in diameter nor smaller than eight one-hundredths of 1 inch in diameter. * * *	Free.

ALL OTHER WIRE.

SUMMARY.

The kinds of wire covered by this survey include certain special rms of iron or steel wire, and wire composed of tungsten, molybdeum, iridium, nickel, solder, and various alloys.

Production and export statistics for such wire are not available. mports since 1910 have varied from a maximum of $310,550 in 1911 a minimum of $18,181 in 1913. In no year from 1914 to 1919, clusive, were imports valued at less than $73,800. Most of these mports have consisted of iron or steel wire other than round or flat.

In the production of wire of special shapes and rare metals, Ameriin manufacturers do not have the advantages of large-scale produc-on and standardized processes that they have in the production of und wire of iron or steel or copper. The relatively small plants in ngland are generally better adapted to the production of these ads of wire than American plants, and England is a leading producer.

The rate of duty under the act of 1913 is 15 per cent ad valorem.

All other wire [1]—Summary table.

Year.	Value (imports for consumption).	Amount of duty.	Actual or equivalent ad valorem rate.	Year.	Value (imports for consumption).	Amount of duty.	Actual or equivalent ad valorem rate.
			Per cent.				*Per cent.*
[illegible]	$84,925	$29,704	35.05	1915	$99,074	$14,861	15.00
[illegible]	310,550	108,784	35.03	1916	87,114	13,067	15.00
[illegible]	111,033	38,927	35.06	1917	92,247	13,837	15.00
[illegible]	18,181	8,181	45.00	1918	81,875	12,281	15.00
[illegible]	107,987	16,614	15.38	1919	73,837	11,076	15.00

[1] See below for description of "All other wire." The statistics on this page represent the total of those on [illegible].

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 114. * * * all other wire not specially provided for this section * * *, 15 per cent ad valorem.

DESCRIPTION.

Wire specially provided for in the tariff act of 1913 includes round n or steel wire; wire composed of iron, steel, or other metal, cept gold or silver, covered with cotton, silk, or other material; rset clasps, corset steels, dress steels, and all flat wires; telephone, legraph, and other wires and cables composed of metal and rubber

or of metal, rubber, and other materials; iron and steel wire coated by dipping, galvanizing, or similar process with zinc, tin, or other metal; barbed wire, fencing wire, and baling wire; lead wire; tinsel wire; and platinum wire. These products have been discussed in other surveys and are, therefore, not included in this survey.

The classification "All other wire" includes certain special forms of iron or steel wire, other than round or flat, and all nonferrous metal wire except platinum wire, lead wire, and tinsel wire, which are specially mentioned in the tariff. In Commerce and Navigation, however, imports of wire of brass, bronze, and copper are separately compiled. The statistics on page 66 exclude, therefore, not only the wire specially provided for in the tariff, but also these three kinds of wire, which are treated in separate surveys. Among the wire included in this survey wire composed of tungsten, molybdenum, iridium, nickel, solder, and various alloys, together with special forms of wire, such as that used for umbrella ribs, pinions, etc., may be mentioned, the designation "wire" being more definite than that of "manufacture of" the constituent metal.

DOMESTIC PRODUCTION.

Materials.—Most of the imports of the wire included in this survey consist of wire of iron or steel other than flat or round, such as that used for umbrella ribs, pinions, etc. In respect to the raw material used in such wire American manufacturers are at no disadvantage.

Equipment and methods of production.—The outline of the process of manufacture of iron and steel wire contained in the survey on "iron and steel round wire" applies in general to the drawing of other wire. This process consists, in brief, in drawing the wire through successively smaller dies mounted on a draw bench by means of power applied through the reels upon which the wire is ultimately wound. The dies are commonly of steel, but diamond dies or other pierced stones are used to draw very fine wire. Tungsten filaments used in electric lights are drawn through diamond dies.

Organization.—The wire here considered is not made on a large scale, the demand being limited. No production statistics are available.

Domestic production and consumption.—Neither production statistics nor export statistics being available, there is no good basis on which to estimate the relation of domestic production to domestic consumption. The fact that imports of iron and steel wire other than round or flat (n. s. p. f.) have been persistent since 1910 indicates that domestic manufacturers have not been producing on a large enough scale to supply the domestic market.

Domestic exports.—Statistics are not available.

FOREIGN PRODUCTION.

Great Britain occupies a leading position as a producer of wire of special shapes, such as umbrella rib and pinion wires. British wire drawers are more inclined to cater to these special kinds of work than American firms who have developed the business along bulk lines.

IMPORTS.

orts of wire of iron and steel other than round or flat have ersistent since 1910. Comparable statistics prior to that date t available. The value of annual imports since 1910 has varied a minimum of $13,841 in 1913 to a maximum of $281,112 in In no year from 1914 to 1919 were imports valued at less than 0. Imports of wire of metals, and metal compositions, n. e. s., 1910 have varied from a minimum of $4,340 in 1913 to a maxi- of $39,505 in 1917. In no year from 1914 to 1919 were imports h wire valued at less than $13,500.

PRICES.

ause of the various kinds of wire included in this survey, it is cticable to quote either foreign or domestic prices. These wires of special character are alwa s more costly than plain, round, t wires which are produced in bulk and in well-standardized nd shapes.

TARIFF HISTORY.

the act of 1883 iron or steel wire was dutiable at from 1½ to 3 per pound, according to the size, and if galvanized one-half ent per pound in addition. Wire of other metals included in rvey was dutiable by that act at 45 per cent as manufactures tal not specially provided for. By the act of 1890 the lower f duty on iron or steel wire was reduced to 1¼ cents per pound. pper limit of the duty on such wire and the duty on wire of other s remained the same.

the act of 1894 "all other iron or steel wire" was made dutiable per cent and wire of other metals not specially provided for at r cent ad valorem. By the act of 1897 all wire not specially ded for was made dutiable at 45 per cent ad valorem, by the 1909 at 35 per cent, and by the act of 1913 at 15 per cent ad m. In both 1897 and 1909 an additional duty of two-tenths nt per pound was placed on iron or steel wire coated by dipping, izing, or similar process.

COMPETITIVE CONDITIONS.

he production of the wires here considered, American manufac- do not have the advantages they enjoy in making ordinary wire n, steel, copper, and brass which are made on a large scale by rdized processes, thus permitting American producers to manu- e at a low cost and to realize fully the benefit of their advan- s position in respect to raw materials and large home market. naking of wires of special shape has been more highly developed eat Britain than in this countr-. Umbrella ribs were invented urport, near Sheffield, England, and that area is still the chief cing center. The relatively small plants in England are gen- better adapted to the production of these special kinds of wire are almost invariably drawn through single blocks and never e continuous s, stem, which latter permits the full utilization of nical equipment with consequent reduction of labor costs. The dual skill and experience of the workman is, therefore, a much

more important factor in the production of these kinds of wire and the output depends chiefly upon the ability and industry of the operative. In England the skilled workers are paid almost exclusively on the basis of their output, their earnings averaging in early 1920 between £5 and £8 per week of 47 hours. Auxiliary labor in the works received between 65 and 80 shillings per week. Wages for a similar class of work in the manufacturing districts in the United States would probably be not much higher on the basis of normal exchange than those of the best-paid English workers, although the average wage would probably be a little higher.

Iron and steel, and manufactures of; wire, and manufactures of; all other wire n. s. p. f.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	35 per cent	589,139	$76,589	$26,894	$0.130	35
1911	do	1,008,463	281,112	98,389	.175	35
1912	do	643,944	86,495	30,273	.134	35
1913 [2]	45 per cent	56,792	13,841	6,228	.244	45
1914 [3]	do	1,200	200	90	.167	45
1914 [4]	15 per cent		80,068	12,010		15
1914 [5]	Free (Sec. IV, J 5)		23			
1915	15 per cent		85,584	12,835		15
1916	do		60,323	9,048		15
1917	do		52,742	7,911		15
1918	do		61,752	9,263		15
1919	do	275,885	56,435	8,465	.205	15

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] Treasury decision 32400.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] For construction and equipment of vessels.

Iron and steel, and manufactures of; wire, and manufactures of; all other wire, n. s. p. f., coated by dipping, galvanizing, or similar process with zinc, tin, or other metal—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	½ cent per pound plus 45 per cent.	19,558	$2,517	$920	$0.129	36.55
1911	do	45,676	5,882	2,150	.129	36.55
1912	do	32,515	4,051	1,483	.125	36.61

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Metals, metal compositions, and manufactures of, n. e. s.; wire, n. s. p. f.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1910 [1]	35 per cent		$5,569	$1,949		35
1911	do		24,556	8,245		35
1912	do		20,187	7,170		35
1913 [2]	15 per cent		1,340	1,953		45
1914 [3]	do		1,188	535		45
1914 [4]	15 per cent		26,531	3,980		15
1915	do		13,510	2,027		15
1916	do		2,791	1,019		15
1917	do		39,705	5,956		15
1918	do		20,125	3,018		15
1919	do		17,102	2,610		15

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] Treasury decision 32600.
[3] July 1, to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913

Act of—
Year.
1883

INSULATED WIRES AND CABLES.

SUMMARY.

Domestic insulated wires and cables are made in establ
whose principal products are electrical machinery, appara
supplies and in the wire departments of rolling mills. The A
manufacturing capacity is amply sufficient to meet any d
that may be made upon the industry. In 1914 there were 7
lishments making insulated wires and cables; the total out
valued at $69,505,573, of which over 63 per cent was prod
New York, New Jersey, and Illinois.

Great Britain, Germany, and France are important pr
countries, but only small quantities of their products are sold
United States.[1] Prior to 1913 the American market was pra
closed to foreign producers by the high rates of import duty
that time the abnormal world conditions prevailing and the in
demand in Europe for home consumption have been im
factors in curtailing exportation to the United States.

The United Kingdom doubtless has some advantage bec
the larger experience of its manufacturers and the bette
equipment of its establishments; the price of rubber, further
ordinarily somewhat lower in Europe than it is in the United

Insulated wires and cables—Summary table.

Year.	Domestic production.[2]	Imports for consumption.[3]	Domestic exports.[4]	Ratio to production (per cent). Imports.	Exports.	Value (imports for consumption).	Amount of duty.	Val pe pou
1910[5]	$51,624,747	$44,446	.....	.....	.....	$34,446	$13,778	40.
1911	.....	6,143	.....	.....	.....	6,143	2,457	..
1912	.....	11,030	.....	.....	.....	11,030	4,412	..
1913	.....	4,448	.....	.....	.....	4,448	1,779	..
1914	69,505,573	31,062	.....	0.04	.....	31,062	4,620	.....
1915	.....	43,362	.....	.....	.....	43,362	6,504	.....
1916	.....	10,594	.....	.....	.....	10,594	1,589	.....
1917	.....	8,577	.....	.....	.....	8,577	1,286	.....
1918	.....	23,025	.....	.....	.....	23,025	3,453	.....
1919	.....	49,577	.....	.....	.....	49,577	7,437	..
Calendar years:								
1918	.....	17,964	.....	.....	.....	17,964	2,695	.....
1919	.....	44,955	.....	.....	.....	44,955	6,743	..

[1] In 1914 the ratio was about 2,000 of domestic production to 1 of imports.
[2] Census years.
[3] Fiscal years ending June 30.
[4] Not available.
[5] Census year 1909.
[6] Low equivalent caused by change in tariff and to entry free under Sec. IV, J 5, act of Oct

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

h 114. * * *; telegraph, telephone, and other wires composed of metal and rubber, or of metal, rubber, and rials; * * * 15 per centum ad valorem.

DESCRIPTION.

vey includes all insulated wire and cables, submarine, d, and other, suitable for the transmission of electric hough the above paragraph refers only to those in which mployed. Ordinary telegraph wire made of steel and but not insulated is included in Survey on iron and steel

rence between insulated wires for different uses is in the and number of conductors and the amount of insulation. ire requires a heavier insulation than telephone wire, and nd cable require a still heavier insulation than either of the epending upon the volume of electric current transmitted, are commonly of copper, iron, steel, or aluminum. The sulated telegraph and telephone wire has a conductor of covered with a rubber compound or gutta-percha, over ver of cotton thread is woven. For outside use an addi- of preserving material is applied in liquid form as a pro- inst the weather. A cable is a combination of two or ately insulated conductors with a protective covering or bles may be aerial, submarine, or underground, depend- r position; classed according to their uses they are tele- phone, electric light, and power cables, and as to the t of their conductors they are straightway or twisted. different purposes differ somewhat in their construction, general construction is substantially similar, and the escription of underground cables for electric lighting will cables for other purposes, with such exceptions as will be er on. Electric cables for use underground are of two ording as the insulation is or is not moisture proof. In e the insulation is rubber or bitumen, and the lead cover- otection from mechanical injuries only. The second class with jute, hemp, or paper impregnated with oil, wax, or mpound, and the lead covering for this cable is absolutely o prevent the insulation taking up moisture.

dard type of cable for telephone work consists of 400 ires twisted in pairs with about three-inch lay;[1] and the bled in reverse layers, forming a cable about 2 inches in The 200-pair cable is used for main routes, but 100-pair, smaller cables are used for distribution. The insulation dry paper wound loosely on the wire, and the whole is th lead pipe. Submarine cable for telegraph and tele- are much like the underground cables of the first class lighting, but are commonly armored with strands of iron

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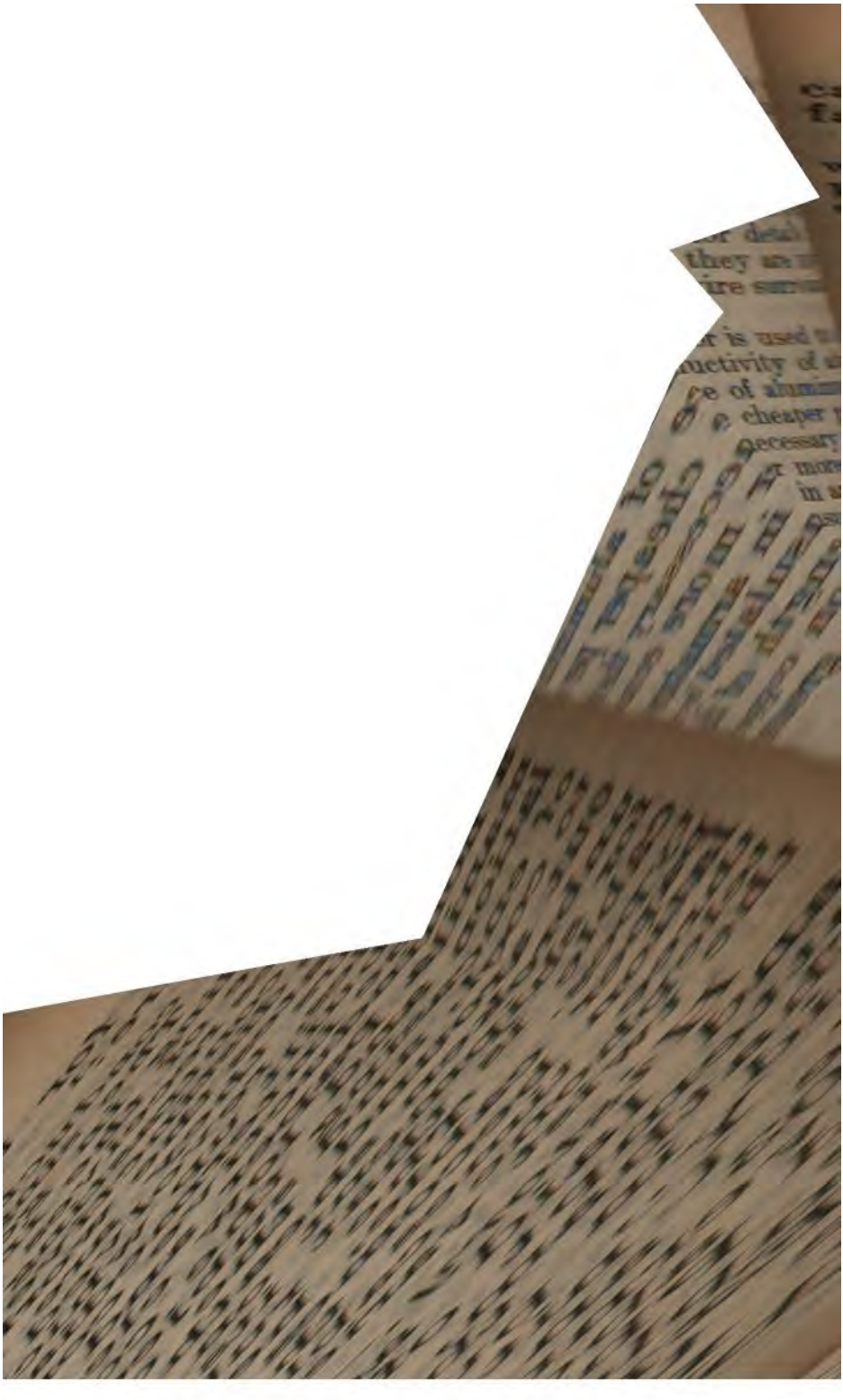
[1] ire makes one turn in every 3 inches of length of strand.
national Encyclopædia, vol. 4.



The insulation for aerial cables is usually in two parts, one of insulating material impervious to moisture, placed next to the wire and the other of some substance which resists abrasion or other mechanical injury. In the most expensive grades of wire more than two coatings are employed.

There are, also, various special cables employed for specific purposes, the construction of which differs somewhat in minor details to the cables mentioned above to suit the uses for which they are intended. In some of these iron or steel wire or iron or steel wire surrounded by a layer of copper is employed.

Insulated wire with aluminum as the conductor is used to a small extent in line transmission. The electric conductivity of aluminum is about 50 with copper at 90. When the price of aluminum is less than twice the price of copper aluminum is the cheaper per unit of electric current conveyed, but when insulation is necessary the smaller size of the copper wire generally makes the latter more economical. A recent development is the use of aluminum wire in armature windings and other electrical apparatus, the wire being insulated by means of a thin adhering film of oxide. The dielectric strength of this film is claimed to be equal to that of the insulation used on copper wire, and the net section for the same current capacity is no greater than that of an insulated copper conductor.

DOMESTIC PRODUCTION.

In 1914 the total insulated wire produced in the United States amounted in value to $69,505,573, having increased to this amount from $51,624,737 in 1909.

In 1914 the greater part of the insulated wire and cable production was made in 64 establishments whose chief products were "electrical machinery apparatus and supplies." The wire departments of 13 rolling mills and other concerns produced 22.6 per cent of the total tonnage. Over 63 per cent of the product was made in New York, New Jersey, and Illinois. Massachusetts, Rhode Island, and Connecticut were also important.[1]

Materials.—The principal materials used in making a standard insulated wire are copper wire, paper, and rubber. Cable requires a sheathing of lead pipe and, in submarine cable, the insulation is commonly of gutta-percha, and the lead pipe is wrapped with steel wire.

Supplies of copper wire, paper, and lead pipe are obtained chiefly in the United States and gutta-percha principally from the Straits Settlements, East Indies, and British Africa; before the war (1914–1918) the quantities of gutta-percha received annually from Germany were second in importance only to those from the Straits Settlements. India rubber is received in largest quantities from the East Indies and Brazil.

Process of manufacture.—No difference of very great importance exists between the manufacture of the various kinds of cables now in use, any difference being due chiefly to the size, kind, and quantity of insulation. The following method of making a standard type of

[1] U. S. Census of Manufactures, 1914, Vol. II, pp. 252 and 287.

s and disadvantages.—The British manufacturer must
er, and this comes chiefly from the United States, but he
ticular disadvantage on this account, since the price of
the two countries is not widely different. Rubber ordi-
a little less in the United Kingdom than it does in the
s. English establishments doubtless have a great advan-
ost of manufacture, due largely to the greater experience
lant and equipment.[1]

—The electrical industry in Germany, long of importance,
ing at a rapid rate until checked by the war in 1914.
in Germany from other countries was of small signifi-
eas German competition in foreign countries began to
siderable importance. Exports of electrical appliances
power transmission, which in 1909 amounted to 20,600,-
ncreased to 74,000,000 in 1913, while, on the other hand,
ports of electrical supplies, including in addition to the
oned appliances, electrical machinery, and incandescent
inted to only 7,000,000 marks.[2]

influential factor of the electrical industry in Germany,
e most important in acquiring foreign trade, has been the
Elektrizitäts-Gesellschaft, of Berlin, one of a few gigantic
abines which are reported to have working agreements,
exploitation of foreign business is greatly facilitated.
ation, capitalized at 155,000,000 marks, has branches all
rld and working agreements with many large electrical
s abroad. The other large concerns, Siemens-Halske and
uckert, have similar connections.[3]

the war brought about important changes: It destroyed
ing agreements; the country emerged from the conflict
rippled; stocks of copper and other raw materials were
d new supplies were hard to get from outside sources;
decreased, and Germany, temporarily at least, lost its
n important international competitor.

IMPORTS.

wires and cables are imported from England, Germany,
The amounts are comparatively small and fluctuate
e largest annual importation since 1910 occurred in the
1919, and amounted to 218,507 pounds; the smallest
1913, and amounted to 34,205 pounds.

to domestic production, the annual amounts imported
ant; the ratio in 1914 being about 2,000 to 1.

TARIFF HISTORY.

since 1883 and up to 1913 on wire covered with cotton,
material changed with each new act of Congress.
1883 imposed specific rates of duty of from 1½ to 3 cents
wire of iron or steel, depending upon the size of the wire,

[1] special agent of the Tariff Commission to England.
[2] oldstein in the Electrical World, Mar. 8, 1919, p. 488.
[3] ommerce: "German Trade and the War." 1918.

and several of the firms specialize on this type as their main product. Doubtless the largest manufacturer of telephone cable is the Western Electric Co., a branch of the American firm of the same name. In the neighborhood of 60 per cent of the cost of electric cable is represented by the cost of copper. The plant capacity is said to be ample to supply the world needs of all classes of cable, and only about one-tenth of it is utilized under normal conditions.

The manufacture of ordinary cotton-covered wire, used largely in electrical machinery and apparatus, is still another industry, which is carried on by establishments making cotton-mill products; there are only a few manufacturers who make cotton-covered wire their chief product. Most of these manufacturers buy their copper in the form of wire and merely spin the cover. The business is considered largely as a speculation in the copper market rather than as a legitimate manufacturing industry. The cost of covering is slight and the chief consideration is the price of copper. Most of the large electrical machinery corporations make wire for their use, but occasionally purchase it from other producers when the market situation warrants.

The quality of the British cable is claimed to be much superior to the cable made in other countries. British manufacturers say that much of the American-made cable is adapted only to a comparatively dry climate and is made by methods that can not be used in the production of high-class insulated wire. The main feature is the character of rubber mixture. They say, furthermore, that American requirements are not as rigid as those of the United Kingdom, the climate being less damp and the temperature less changeable.[1]

Tendencies of the industry.—The Government departments are taking a larger and more practical interest in the development of British trade. The foreign office and the improved consular service are expected to cooperate actively with the British manufacturer, and much useful work has already been done by the Department of Overseas Trade. During the war period (1914–1918) the electric industry in the United Kingdom made a large growth. This was due not only to the enormous increase in home consumption but also to the fact that the Government removed many of the restrictions that were formerly imposed upon the industry, so that, in fact, the industry may now be said to have the elements of strength that formerly characterized the manufacture of electrical goods in Germany, and which were summarized by the board of trade committee on the electrical trades as follows:

> The advantages possessed by the German industry, none of which had its counterpart in this country, were the absence of detrimental legislation, the coincidence of industrial development with the advent of applied electricity and its earlier use in the home market, protected by import duties, state influence exerted on official departments to buy within the country, concentration of control and organization in the hands of powerful corporations, effective standardization, a favorable system of financial and governmental support, and preferential shipping and railway rates.

Further data on associations and consolidations in the industry are given in a report of the British metal investigation by the United States Tariff Commission.

[1] Paul M. Tyler, special agent of the Tariff Commission to England.

Following the outbreak of the war, the industry
l with a shortage of materials. Many skilled
ed in other industries and various difficulties
raw-material supplies; besides, the commercial
reduced, and increased Government require-
:e. At the close of the war the available sup-
were even more depleted, prices rose to uncom-
ıer manufacturing costs increased fully as much
ed in the United States. Production was fairly
England after the armistice, but domestic re-
)untry were largely increased as a result of the

le—Production in United States—States (calendar years).

[From Federal Census.]

	1899	1904	1909	1914
.....	$6,119,878	$10,911,897	$9,485,282	$19,178,327
.....	1,701,574	8,234,885	13,945,425	15,038,971
.....	3,912,584	5,122,464	7,741,411	6,045,876
.....	2,696,155	2,885,052	2,796,825	3,299,485
.....	1,938,075	2,156,389	4,205,509	6,206,803
.....	722,069	3,666,313	9,487,006	9,626,775
.....	693,456	1,001,522	2,194,474	6,799,411
.....	330,000	(1)	(1)	.....
.....	96,793	(1)	(1)	.....
.....	65,905	(1)	(1)	.....
.....	15,512	(1)	(1)	.....
.....	.....	541,197	1,768,805	3,309,925
.....	21,292,001	34,519,699	51,624,737	69,505,573

cables—Production in United States (calendar year).[1]

Value.	Year.	Value.
.... $21,292,001	1909	$51,624,737
.... 34,519,699	1914	69,505,573

:hinery, apparatus, and supplies.

other wires and cables, composed of metal, rubber, and other ils—Imports for consumption—Revenue.

ıty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
	Pounds.				*Per cent.*
.....	127,241	$34,446	$13,778	$0.271	40
.....	50,711	6,143	2,457	.121	40
.....	52,059	11,030	4,412	.212	40
.....	34,205	4,448	1,779	.129	40
.....	2,425	299	119	.123	40
.....	.....	30,010	4,501	.....	15
5, act	.....	753	.....	.....	.....
913.					
.....	.....	43,362	6,504	.....	15
.....	.....	10,594	1,589	.....	15
.....	.....	8,577	1,286	.....	15
.....	.....	23,025	3,453	.....	15
.....	218,507	49,577	7,437	.227	15
.....	.....	17,984	2,695	.....	15
.....	174,981	44,955	6,743	.259	15

ct of 1909.
under act of 1913.
ent of vessels.

plus 4 cents per pound for covered wire. Covered wire of copper or other metal was given a rate of 45 per centum ad valorem as manufactured articles, or wares, not specially provided for.

In the act of 1890 the rate was fixed at 5 cents per pound on covered wire of iron or steel, regardless of the size of the wire, whereas the paragraph dealing with covered wire of copper or other metal remained unchanged.

The act of 1894 placed an ad valorem rate of duty on all covered wire of iron or steel valued above 4 cents per pound, and reduced the rate on covered wire of copper or other metal to 35 per cent ad valorem.

The act of 1897 provided for all covered wire at a uniform rate of 45 per cent ad valorem, an increase over the old rate.

The act of 1909 specified a rate of duty of not less than 35 per cent ad valorem on all covered wire, and gave specific mention to wire containing rubber in its composition, and fixed the rate at 40 per cent ad valorem. The new rates operated as reductions in the tariff.

The act of 1913 reduced the rates on all kinds of covered wire except gold and silver wire, to 15 per cent ad valorem.

From existing statistics it is not possible to ascertain the effect on the volume of imports of the reduction or increase in the rate of import duty.

COMPETITIVE CONDITIONS.

Insulated wire comes to the United States only to a small extent from England, Germany, and France. American manufacturers are sufficiently equipped to supply all domestic demands, and the raw materials necessary are obtained in this country in amounts amply sufficient to meet requirements; whereas England, Germany, and France must rely chiefly on foreign sources for their copper supplies which are derived chiefly from the United States. These countries are, however, at no particular disadvantage on this account, since price differences of the metal throughout the world are generally within the normal range of monthly market fluctuations. Normally iron and steel are readily available in all the countries, and at prices that do not yield any country special advantage. Rubber, ordinarily, costs a little less in Europe than in the United States.

English establishments doubtless have an advantage in the cost of manufacture, due largely to greater experience and better plant equipment. The quality of the British cable is claimed by English manufacturers to be much superior to that of cable made in other countries.[1]

The amount of foreign insulated wire and cable sold in the United States in the past was small, probably in part because of the high rates of import duty imposed prior to the passage of the act of 1913. The effect of the lower rate of duty in the act of 1913 can not be determined on account of the abnormal conditions that have since prevailed. British manufacturers claim that the maximum duty which would allow them to compete on a purely price basis on even terms in the United States would be 10 per cent.[1]

[1] Paul M. Tyler, special agent of the United States Tariff Commission to England.

t of the war.—Following the outbreak of the war, the industry ope was faced with a shortage of materials. Many skilled s were absorbed in other industries and various difficulties ith regard to raw-material supplies; besides, the commercial l was greatly reduced, and increased Government require- took preference. At the close of the war the available sup- raw materials were even more depleted, prices rose to uncom- ights, and other manufacturing costs increased fully as much e costs increased in the United States. Production was fairly aintained in England after the armistice, but domestic re- ents in that country were largely increased as a result of the ation systems.

lated wire and cable—Production in United States—States (calendar years).

[From Federal Census.]

States.	1899	1904	1909	1914
	$6,119,878	$10,911,897	$9,485,282	$19,178,327
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eits	693,456	1,001,522	2,194,474	6,799,411
	330,000	(1)	(1)	
pshire	96,793	(1)	(1)	
	65,905	(1)	(1)	
	15,512	(1)	(1)	
		541,197	1,768,805	3,309,925
l	21,292,001	34,519,699	51,624,737	69,505,573

d in all other.

nsulated wires and cables—Production in United States (calendar year).[1]

Year.	Value.	Year.	Value.
	$21,292,001	1909	$51,624,737
	34,519,699	1914	69,505,573

d under electrical machinery, apparatus, and supplies.

h, telephone, and other wires and cables, composed of metal, rubber, and other materials—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
:		*Pounds.*				*Per cent.*
	40 per cent	127,241	$34,446	$13,778	$0.271	40
	do	50,711	6,143	2,457	.121	40
	do	52,059	11,030	4,412	.212	40
	do	34,205	4,448	1,779	.129	40
	do	2,425	299	119	.123	40
	15 per cent		30,010	4,501		15
	Sec. IV, J 5, act of Oct. 3, 1913.		753			
	15 per cent		43,362	6,504		15
	do		10,594	1,589		15
	do		8,577	1,286		15
	do		23,025	3,453		15
	do	218,507	49,577	7,437	.227	15
ear:						
	do		17,964	2,695		15
	do	174,981	44,955	6,743	.259	15

o Oct. 3, 1913, under act of 1909.
1913, to June 30, 1914, under act of 1913.
struction and equipment of vessels.

Court and Treasury Decisions.

Cable used for making connections with a telephone switchboard and consisting of 64 wires bound together which, both individually and in the group, were covered with various metals for insulating and waterproofing purposes, was declared to be an "article" within the proviso in paragraph 137 of the act of 1897 for "articles manufactured from copper wire" and was not dutiable under the provision in the same paragraph for "wire not specially provided for, whether uncovered or covered," nor under the metal manufactures provision in paragraph 193. (Salt *v.* United States, 134 Fed., 1021.)

Telegraph cable, composed of iron wire and gutta-percha was held dutiable as a manufacture in chief value of iron under the act of 1861, section 22. (United States *v.* U. S. Telegraph Co., 28 Fed. Cas., 353.)

The provision for "telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other metals," does not include such wires and cables containing gutta-percha and no rubber.

Steel wire rope covered with hemp was held properly classified under paragraph 284 of the act of 1913 as a manufacture in chief value of hemp rather than under paragraph 268 as cable and cordage. (Abstract 38558.)

Insulated wire and cables—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883	182	Iron or steel wire, smaller than No. 5 and not smaller than No. 10 wire gauge.	1½ cents per pound.
		Smaller than No. 10 and not smaller than No. 16 wire gauge.....	2 cents per pound.
		Smaller than No. 16 and not smaller than No. 26 wire gauge.....	2½ cents per pound.
		Smaller than No. 26 wire gauge.....	3 cents per pound.
		Provided, That iron or steel wire covered with cotton, silk, or other material * * * shall pay 4 cents per pound in addition to the foregoing rates.	
		And provided further, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made, either wholly or in part.	
	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * metal and whether partly or wholly manufactured.	45 per cent ad valorem.
1890	148	* * * *Provided*, That iron or steel wire covered with cotton, silk, or other material, * * * shall pay a duty of.	5 cents per pound.
		And provided further, * * * That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made either wholly or in part.	
	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1894	124	* * * All other iron or steel wire * * * covered with cotton, silk, or other material, or metal, * * * valued above 4 cents per pound, shall pay a duty of.	40 per cent ad valorem.
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
1897	137	* * * Iron or steel or other wire not specially provided for in this act, * * * covered with cotton, silk, metal, or other material, valued at more than 4 cents per pound.	45 per cent ad valorem.
		Provided, That articles manufactured from iron, steel, brass, or copper wire shall pay the rate of duty imposed upon the wire used in the manufacture of such articles and, in addition thereto, 2½ cents per pound, * * *.	Duty on wire was plus 1½ cents per pound.

Insulated wire and cables—Rates of duty—Continued.

of— Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
135	* * * All wire composed of iron, steel, or other metal except gold or silver, covered with cotton, silk, or other material, * * * shall pay a duty of—	Not less than 35 per cent ad valorem.
	* * * Telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials.	40 per cent ad valorem.
114	* * * Wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material; * * * telegraph, telephone, and other wires and cables composed of metal and rubber, or metal, rubber, and other materials; * * *	15 per cent ad valorem.

WIRE ROPE AND STRAND.

SUMMARY.

PRODUCTION, IMPORTS, EXPORTS.

The production of wire rope and strand in 1914 was slightly less than $13,500,000 in value. War demand for the product resulted in the probable doubling of production, 1914–1918. This growth indicates the importance of wire rope for military and naval use; in peace time, its use is very widespread, almost all industries employing it, either in the form of guy ropes, or as hoisting and hauling rope.

The firms manufacturing wire rope and strand are well scattered. In 1914, there were establishments in Massachusetts, New Jersey, Pennsylvania, Indiana, Missouri, California, Washington, and other States.

Wire rope has formed a steady but relatively very small import into the United States, and one which was increasing, 1909–1914. The largest import was in the latter year, when an amount valued at $146,000 came in, as against $109,000 the year before. This increase follows the act of 1913, lowering duties, but a certain increase was to be expected under the old rate. Although the value of the imported rope formed in 1914 only 1.1 per cent of that of the domestic production, the steadiness of the import prior to the breaking out of the war in Europe indicates that some foreign rope found a regular market in this country. There is a very marked decline in imports during the period of the war.

Although complete statistics are lacking, it is clear that the export of wire rope exceeded the import, and that the amount produced does more than meet the domestic demand.

FOREIGN RAW MATERIAL.

Prior to the war, a considerable percentage of the wire used was imported rope wire, or wire made from imported wire rods admitted, under the act of 1913, at 15 and 10 per cent, respectively. Since the decline in the import of wire following 1914 domestic wire has been substituted and has proven satisfactory. The duty falling on the raw material has thus become of less importance as a determining factor in fixing the duty on the rope.

COMPETITIVE CONDITIONS.

The imported rope enters into direct competition with the American product. Although it is largely marine rope, it finds general usage also in other fields. It is imported from Great Britain.

The bulk of the wire rope used in Mexico and Central America is from the United States, and a large amount is sold in South America.

merican rope competes with British on the Canadian market spite the preferences extended to British rope by the Canadian riff. These form the principal export markets, but American pes go to all parts of the world. They have a reputation for inability greater than the British or German rope. The latter is too poor a quality to be of significance on the domestic market, t forms the main competitor of the British rope in South America.

REVENUE.

Although there was a particularly heavy increase in the amount wire rope imported following the passage of the act of 1913, as mpared with the amount previously imported, it was not sufficient bring the amount of revenue collected under the decreased rate to that previously collected. The free importation of a large mount of rope for the construction and equipment of vessels also creased the revenue, bringing the actual rate paid by the total mports as low as 23 per cent in 1914. The effect which the lower te and free admission of marine rope would have had under normal nditions in the following years can not be judged, because of the arked decline of imports due to the war.

The revenue formerly produced by the duty was small, averaging pproximately $49,000 per year for the five years 1909–1913. As a ax on the consumption of wire rope, this amount is of small signi- cance.

Wire rope and strand—Summary table.

Year.	Domestic production in establishments drawing wire.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio of imports to production.		Value (imports for consumption).[2]	Amount of duty.[2]	Value per pound.	Actual or equivalent ad valorem rate.
				Quantity.	Value.[3]				
	Tons.	*Tons.*		*Per ct.*	*Per ct.*				*Per ct.*
1909	45,303	461		1.0	0.6	$67,057	$33,961	$0.073	50.6
1910		723				143,542	66,167	.099	46.1
1911		702				98,405	49,020	.07	49.8
1912		708				94,840	47,273	.067	49.8
1913		864				109,254	48,678	.063	44.5
1914	52,735	[4] 1,336		2.5	1.1	[4] 145,977	[4] 33,668	.054	23.0
1915		[4] 727				[4] 77,594	[4] 22,286	.053	28.7
1916		[4] 251				[4] 46,707	[4] 14,012	.093	30.0
1917		[4] 207				[4] 48,696	[4] 14,609	.118	30.0
1918		[4] 59	[5] $3,752,781			[4] 13,096	[4] 3,929	.110	30.0
Calendar years:									
1918		[4] 124	4,225,019			[4] 24,833	[4] 2,022	.100	30.0
1919		[4] 54	4,379,478			[4] 20,064	[4] 5,573	.185	30.0

[1] Calendar year, or business year most nearly corresponding.
[2] Fiscal years ending June 30. Figures do not include free imports under "Section IV, J. 5."
[3] Includes in value of production, wire rope made both in drawing wire establishments and other establishments.
[4] After Oct. 3, 1913, imports specified as "wire rope."
[5] Wire rope and cables.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 114. * * * wire rope, 30 per cent ad valorem.

DESCRIPTION.

The earliest and simplest form of wire rope is the selvage construction, which is merely a bundle of parallel wires bound together by wire wound about them. The Brooklyn Bridge ropes are of such construction.

Wire rope is ordinarily made by twisting together a number of wire strands about a core of hemp or wire to form a rope. Wire strand consists of wires twisted together usually about a central wire. The standard forms are 7-wire strand, formed of 6 wires laid over a center wire, and 19-wire strand, formed by laying 12 more wires about these. Strands of a greater number of wires—37, 61, or 91—may be so built up, but are seldom constructed. Strands for the construction of certain ropes used on shipboard are made up of wires, usually 12, twisted about a hemp core. The direction in which the wires of the strand are twisted depends upon the design of the rope into which they go. Strand is also manufactured for use without forming into rope. This strand is comparable only to the cheaper forms of rope not used over sheaves.

Standard grades of rope are formed of 6 strands of 7 wires each (6 by 7 rope) and 6 strands of 19 wires (6 by 19 rope). Sometimes a greater number of strands, often 8, are used. A kind of rope called tiller rope is constructed of 6 (6 by 7) wire ropes, each containing a hemp core and laid about a central hemp core.

Various patented forms of wire rope have also been developed in order to increase resistance to wear, among which are locked-coil rope and flattened strand rope. The first of these is made of wire of special cross section designed to interlock with each other. These are not formed into strands, but laid together in concentric layers about a wire core to form rope of approximately circular cross section.

Flattened strand rope is composed of strands which are constructed about a core wire of elliptical or triangular cross section. The shape of the strand is thus such that upon being laid into rope the flattened surface is presented at the circumference.

Flat rope is made of a number of 4-strand, 7-wire, round ropes without cores, placed side by side, and sewed together with soft iron wire.

The term "lay" is applied to the direction and length of twist of the strands and wires of the rope. The wires forming the strands are usually twisted together toward the left, the strands forming the rope to the right. This is the regular method in hemp rope making; its object is to bind the rope together more securely and facilitate splicing. In some ropes, the wires and strands are laid up in the opposite direction. Both the wire of the strands and the strands may be twisted in the same direction. This arrangement is called the "lang-lay." All flattened strand rope is so laid up.

Kinds.—Wire rope may be divided into kinds according to whether the rope is stationary or moving relative to the load it supports. The first kind of rope is called standing rope. It includes guy ropes of all kinds, standing rope used on ship-board, rope used in the construction of suspension bridges, and for other purposes.

Standing ropes do not require flexibility. Selvage construction has been used for the large cables of suspension bridges. Wire strand is widely used as guy rope, and 6 by 7 rope, since the flexibility gained by a greater number of wires is not desired. Standing ropes

e often galvanized and sometimes made with a wire rather than a mp center. The rope used as the track cable for aerial tramways sometimes of locked coil construction, which presents smooth and ear resisting surface.

Ropes which are in motion relative to the load they bear are frently called running ropes.[1] These ropes may be further classified, cording to the nature of their use, into haulage and hoisting ropes. oth require flexibility, the former to a less extent than the latter. aulage ropes are thus often of the 6 by 7 construction, since the earing quality of such ropes is better than a similar size of 6 by 19 nstruction. It can be used where big drums are practicable and e rope is exposed to severe conditions of wear. Rope of lang-lay more wear resisting than ordinary lay, since it exposes a greater ngth of wire at the bearing surface, and flattened strand rope lways lang-lay) has the same advantage; they are often used.

Hoisting ropes—as those used on derricks and elevators—have to ss over small sheaves and require still greater flexibility; 6 by 19 pe is ordinarily used, and other ropes of greater flexibility, attained a larger number of wires per strand, by more strands, or by plac- g a core of hemp in the strands.

Finish.—Standing ropes are ordinarily galvanized, but such a eatment is not effective for running ropes, since the wear to which e latter are subjected quickly wears away the galvanizing, making em more subject to rust than if no coat of zinc had been applied. me galvanized hoisting ropes, however, are used on the vessels in ew York Harbor. Running ropes are treated with a lubricating ixture, designed to protect the outer wires and to provide against ternal friction.

Uses.—Wire ropes are used extensively in mining, lumbering, well rilling; in construction work for elevators on shipboard; in dredging nd quarrying; as guy ropes for all purposes; in fact, hardly an dustry does not use it to some extent, in one form or another. Flat ire ropes are occasionally used to hoist the mine basket in order to revent spinning, but the round rope is more usual. Wire ropes are sed to some extent in the transmission of power. This is economical or a distance of over 100 feet and under 300.

DOMESTIC PRODUCTION.

Quantity.—The manufacture of wire rope falls under two classifica- ions in the census—wire and wire work. In the former class are stablishments which draw their own wire, whether from rods which hey purchase or which they manufacture. In 1909 such establish- ents made 45,303 tons of iron and steel wire rope, valued at 6,683,771. Establishments classed under wire work—i. e., which ought their wire—manufactured a product valued at $5,406,923. he total production was thus valued at $12,090,694.

In 1914 the wire mills produced 52,735 tons, valued at $7,973,537, nd establishments classified as wire work a product of $5,462,786. he total value was thus $13,436,323, an increase of 11 per cent over 909.

[1] More correctly applied to a running rope on shipboard, constructed of 8 strands, each consisting of wires about a hemp core, laid about a hemp core.

The increase in production since the beginning of the war has been estimated variously at 35, 75, 100, 293 per cent. Production has probably more than doubled in value, with a slower increase in amount. The increase in the total amount of wire rods and wire used by 7 companies 1914–1917 was 36 per cent; in value, 161.5 per cent.

History.[1]—A short length of bronze wire stranded rope was excavated from Pompeii, but its use is not known. The first wire ropes used for engineering purposes were the supporting ropes of the Geneva suspension bridge, constructed in 1813. The rope used was of the selvagee construction. In 1835 some ropes of this type were produced for the Freiburg suspension bridge. In this country they have been used on the Niagara suspension bridge, for the main supporting cables of the Brooklyn suspension bridge, and on the Williamsburg bridge.

The first stranded wire rope was made in 1834 by an engineer named Albert, at Clausthal, Germany. It was used for hoisting ore. The ropes manufactured, 1835–1838, were composed of from six to eight strands of four wires each, the wires being about three thirty-seconds inch in diameter. Shortly after the success of these ropes the firm of Felton & Guilleaume, of Cologne, was formed to manufacture them.

The first patent on wire-rope machinery taken out in England was granted in 1840. This machine made ropes containing, like the ropes of to-day, hemp cores—a distinct step in advance. The strands made also contained such cores.

In the United States the first manufacture was in the early part of the decade 1840–1850.

The material of construction changed constantly; iron was first used, then crucible cast steel. Later, the higher carbon steel (plow steel or extra high-strength steel) was introduced. All these materials are now in use.

Process of manufacture.—The raw material, wire, is first made into strands. The wire of which the strand is made is wound on bobbins, which are mounted in a cylindrical frame fixed to a horizontal shaft, the whole mounted on bearings so as to revolve with the shaft. The wires from the bobbins are passed through holes in the end of the machine, and as the machine revolves are brought together in a stationary compression box about the core, which is fed through the hollow shaft from the back of the machine. The formed strand is drawn off through this box by a reel. In order that the wires themselves may receive no twist as the machine revolves, the bobbins are kept upright by means of eccentric gearing. The rope closing machines are of a similar construction, but are larger and heavier, and their bobbins, fewer in number, carry the strands instead of wires.

In another arrangement of the machine the rope is twisted vertically, the reels revolving in a horizontal plane about the compression box. This arrangement is advantageous in the construction of rope when the weight of the strands is great.

The speed of the machine varies from 50 to 150 revolutions per minute, or even a greater number. It is regulated by the weight of the material and the permissible strain upon the machinery.

[1] Engineering and Mining Journal, vol. 104, p. 832, Nov. 10, 1917.

Materials.—Wire rope is commonly constructed of iron or steel. cial ropes or strands of other metals are constructed for special poses. The iron and steel wire used in making wire ropes may be ided into three classes: Iron (Swedish), with a breaking point at roximately 80,000 pounds per square inch; crucible steel, with reaking point at from 170,000 to 180,000 pounds per square inch; plow steel, with a breaking point at 200,000 to 250,000 pounds square inch.

The better grades of wire rope and strand are made from acid n-hearth steel, and every process from the ingot to the finishe.. cle is special in its nature. The common grades of strand and ranized guy rope are made from basic open-hearth steel."[1] Besse- steel is also used. Until recent years, foreign steel was superior, to the use of Swedish ores. The superiority of acid open hearth r basic lies in better elimination of the oxygen.

Both wire and wire rods have been imported for manufacture into e rope. The extent of the use of imported material may be judged n the fact that, of the wire used in 1914[2] by five manufacturers lying to the commission's questionnaire,[3] 6½ per cent of the weight, 13.6 per cent of the value, was foreign. Of the wire rods used by such manufacturers, these percentages were 7.7 and 15.7, respec- ly. The wire used was of English make; the rods of Swedish. cessation of imports of such wire since the beginning of the war led to the substitution of domestic material. It has ordinarily ven the equal of the imported, although one manufacturer has en up the manufacture of his best grade of wire rope until he can ain the English wire which has been used to construct it. The eriority of the foreign material has lain in its greater purity,— dom from phosphorus and sulphur.[4]

Relative to the substitution of domestic material, the John A. ebling's Sons Co. states:[5]

We have substituted a special steel of our own make for the Swedish rods previously orted, as we find it to be equal, if not better, in quality and grade than the Swedish l.

The A. Leschen & Sons Rope Co. has found the substituted domestic "equally as good" as that formerly imported.[6]

The iron wire used—a small percentage of the whole—is of great ity and flexibility, though not of great tensile strength.

The gauge of the wires used in making a rope depends on the flexi- y desired; a rope of a large number of small wires, other things g equal, is more flexible than the same size rope constructed of naller number of larger wires. Flexibility may also be obtained ther ways.

The core of the rope is usually of hemp. This absorbs and holds lubricant, acts as a yielding cushion for the strands, thus prevent- friction and wear when the rope is bent over the sheaves and ns. It permits the rope to stretch thus giving to each individual nd its share of the load.

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n A. Roebling's Sons Co. questionnaire returned to the commission, Dec. 6, 1918.
comparable period. see auxiliary file, wire products, p. 20.
ted Sept. 28, 1918.
Survey on Iron and Steel Wire.
tter received by the commission in answer to questionnaire, Dec. 6, 1918.
estionnaire returned to the commission, Jan. 24, 1919.

Wire cores are often used in standing ropes. They do not materially add to the strength of the rope, since they are of much less strength than the strands and would be the first to part under an undue load. They are used where exposure to the weather, acids, or other corrosive agencies would destroy a hemp-cored rope with greater rapidity than the wire-cored rope.

Zinc is used for galvanizing, which is confined almost entirely to standing ropes.

Organization and capitalization.—In 1914 there were 27 firms manufacturing wire rope, of which 12 drew their own wire, and 15 did not. Of the first 12, only 4 were departments of rolling mills, and produced only 8.13 per cent of the value of the total production. Among the various products manufactured by the wire industry,[1] wire rope showed a higher percentage of product manufactured by firms not departments of rolling mills than any other wire product.

In addition to this, a large proportion of wire rope is made by firms who buy wire, and thus fall outside this calculation. This is true, also, of the manufacture of woven-wire fencing, but a much larger percentage than for wire rope was manufactured in the rolling mills in 1914.[2] These figures indicate that there is less connection between the making of wire rope and the processes previous to the drawing of the wire than is the case in the production of other wire products.

Localities of production.—Factories manufacturing wire rope are widely scattered. In 1914 they were located in Massachusetts, New Jersey, Pennsylvania, Missouri, California, Washington, Indiana, and other States. Their location thus seems to be influenced by nearness to the markets, which are widely scattered because of the different industries demanding wire rope; logging (the Pacific coast); mining (the western and middle States); ships rigging and construction (East). Prior to the war, imports of wire and rods for rope making went to factories in the East, and in Missouri and Washington.

The relation of domestic production to domestic consumption.—Complete figures for the export of wire rope are not available, but those at hand show exports well in excess of imports in 1914. In the years 1912–1917, the exports of wire rope made of foreign steel wire—3,420 tons—were exceeded only 20 per cent by the total imports—4,090 tons. It is thus clear that domestic production is in excess of consumption.

Exports.—The bulk of the wire rope exported goes to Canada, Mexico, and South and Central America. In 1912 it was estimated that

[1] Confined to firms drawing their own wire. Their products are classified by the census as: Plain wire; coated wire; wire nails and spikes; wire brads, tacks and staples; barbed wire; wire rope and strand; woven wire fence and poultry netting; other woven-wire products; other fabricated iron and steel wire products.

[2] Value of wire rope and woven-wire fence produced by various classes of establishments, 1914:

	Wire rope.	Woven wire fence.
Rolling mills	$1,092,000	* $13,[illegible]
Wire mills	6,881,000	* 6,[illegible]
Wire-works establishments	5,463,000	15,[illegible]
	13,463,000	34,[illegible]

* Includes poultry netting.

e United States supplied 80 per cent of the wire rope imported into exico, 66 per cent of that into Central America.

In the fiscal year 1918 statistics for the exports of wire rope and bles are given. They were valued at $3,753,000. Of this amount, rance took 36 per cent, Russia 12, Canada 9, Cuba 7, Chile 6, and exico and Panama together 7. The remaining 35 per cent was idely scattered.

These exports are less than the British exports (excluding telephone and telegraph cables) during the calendar year 1917 ($4,978,000) nd slightly greater than those of the following year ($3,607,000).

FOREIGN PRODUCTION.

Great Britain is the chief producer of wire rope; Germany, Belgium, rance, and Sweden also make it. In 1918, a United States manufacturer stated that there were about 40 wire rope firms in England, and in Germany. Of the English firms, 9 have a capitalization of over 100,000 ($486,650).[1]

IMPORTS.

Quantity.—In 1909, 461 tons of wire rope and strand were imported, n amount equal to 1 per cent of the quantity produced by manufacturers drawing their own wire, while its value, $68,000, was equal to 0.6 er cent of the value of the total production of both wire-drawing establishments and other establishments making wire rope and strand. mports increased until 1914, when they amounted to 1,336 tons, alued at $146,000, in amount 2.5 per cent of the production of stablishments drawing their own wire, and in value 1.1 per cent of he value of total production.

In 1917 imports of wire rope had decreased to 207 tons, valued at 49,000. Wire strand was not specified in the act of 1913 and these gures, as those for the last three quarters of 1914, are entered under he caption "wire rope."

Source.—Imports of wire rope come largely from Great Britain. he German export grade is of poor quality, of a grade not used in the nited States.

Classes and varieties.—Prior to the act of 1913 the tariff classed eparately rope made of galvanized and plain wire. Of a total mport of 461 tons in 1909, 117 tons, or 25 per cent, was coated. In 913, of an import of 864 tons, 178 tons, or 20.6 per cent, was coated. The galvanized rope found use largely on shipboard. The act of 913, providing for the free admission of materials for the construction and repair of vessels, separates rope put to such uses.

In the fiscal year 1914, of a total import of wire rope of 1,366 tons, 14 tons, or 30 per cent, was admitted free under these provisions. n the following year the amount imported free was 35 tons, 4.8 per ent of the total import. In the three following years no wire rope as admitted free.

Destination in the United States.—Galvanized wire rope is used xtensively on shipboard, and a portion of the imported rope is put o such uses, as has been shown by the free admission of such rope in 914 and 1915. Galvanized hoisting rope, little used in the United

[1] Hazard Manufacturing Co. Questionnaire returned to the commission Oct. 5, 1918.

States, is largely imported and is used in New York Harbor. A portion of the rope finds its way into other than marine uses—for lumbering (some of it on the western coast), for well drilling, and other purposes.

Character.—Imports, though relatively small, have been continuous and were increasing up to the outbreak of the war. There is a larger import in the fiscal year 1914 than in the preceding years, but coming, as it does, after preceding increases, all of it is not to be explained as being due to the lowering of duties. The decrease in the years following 1914 is the direct result of the war, which decreased shipping facilities and necessitated the use of the British rope at home.

The imported rope enters into direct competition with the domestic, for the product is largely standardized, and foreign and domestic rope find the same uses. The influence of transportation is probably felt in the use of a large part of the rope on shipboard, near the Pacific coast, and (at an earlier date at least) in the lower Mississippi region.

The Tipson-Walton Co., a former importer of wire rope, accounts for the importation as follows:

> For a good many years the quality of the English goods was very much superior to the American, and the prices lower. These differences have gradually been eliminated in part or entirely, so that we have not been importing for some years probably more than one-quarter of our requirements. These goods have been the higher grade goods which up to the time of the war were still cheaper and better in quality than the American. Under normal conditions a large portion of the high-grade wire ropes made in this country is made from imported rods or wire.[1]

The Hazard Manufacturing Co. says of present conditions:

> There are no special features due to the construction of the imported rope, and further the steel is not of higher quality than that produced by American manufacturers at the present time.[2]

Revenue.—In the three fiscal years 1911–1913 the revenue on wire rope and strand averaged $48,323 yearly on an annual average import of $100,833, 48 per cent of the latter figure. In 1914 the revenue was only $33,667.62 on an import of $144,977, or 23.06 per cent. Thus the ad valorem duty of 30 per cent resulted in less revenue being collected than would have been the case under the previous duties if imports had remained the same, while the effect of the free admission of rope for use on shipboard resulted in a decided reduction also. Since that year revenue has fallen off with decreased import, though rising prices have to a certain extent counteracted this movement.

PRICES.

The wholesale prices of wire rope are expressed in certain discounts on a "standard list" of prices. These are the list prices given in the various catalogues and are uniform for the trade. Of the great number of varieties a few have been selected and list prices given on pages 90–92. Thus ¾-inch hoisting rope (6 by 19) is listed at 16 cents per foot if of iron wire, 19 cents if of crucible cast steel wire, 26 cents if of plow steel wire; ¾-inch haulage rope (6 by 7) is listed at 17 and 24½ cents for the last two grades; ½-inch galvanized strand is listed at $5.50 per 100 feet.

[1] Letter of May 19, 1919, to the commission.
[2] Letter of May 8, 1919, to the commission.

These prices remain fixed, and changes in prices are effected by anges in the discount rates allowed by the different companies. ne changes in the prices at which rope was actually sold may be dged from the changes made in the discount rate by one large anufacturer. From October 4, 1912, to March 23, 1915, his dis-unts were, for eastern territory, between 55 less 12½ per cent and ½ less 12½ per cent, depending on the quality of the rope. By the d of 1916, these discounts had decreased to 30 less 12½ per cent nd 20 less 12½. On November 18, 1917, they stood at 20 less 12½ nd 10 less 12½. From November 19, 1917, to August 27, 1918, the ficial discounts were from 30 less 10 per cent to 10 per cent, and on nd after August 28 from 30 less 10 less per cent to 2½ less 10 less per cent.

The prices established by the War Industries Board November 13, 917, and August 8, 1918, vary according to the district in which the pe is sold. Territory east of the western line of Missouri, Minnesota, wa, Arkansas, and Louisiana, and including points on either bank f the Missouri River between Sioux City and Kansas City, Mo., is stern territory. Western territory includes—except points on the est bank of the Missouri River between Sioux City and Kansas City—orth Dakota, South Dakota, Nebraska, Kansas, Texas, and Oklaoma. Wyoming, New Mexico, and Colorado; Montana, Idaho, and tah; California, Oregon, Nevada, and Washington; and Arizona form parate territories for the application of the discounts. Discounts re lower for western than eastern territory, lower yet in the other rritories, and lowest in Arizona. Freight is allowed to station near-st point of destination on shipments of over 200 pounds in eastern nd western territory and Arizona; to certain of the large cities cated in the other territories.

TARIFF HISTORY.

Paragraph 114 of the act of 1913 provides a 30 per cent ad valorem uty upon wire rope. A considerable amount of wire rope was admitted in 1914 and 1915 under Section IV, paragraph J, subsections 5 nd 6 of the act. These two subsections provide that materials for he construction and equipment of United States vessels or those uilt here for foreign account used in the domestic or foreign trade ay be imported under bond, and upon proof of their use for such urposes shall be admitted free of duty. Materials for the repair f United States naval vessels, or other vessels owned or used by he United States Government, or registered after the passage of the ct, are likewise admitted free.

The acts of 1883, 1890, and 1897, in making provision for wire pe, specify both wire rope and strand. The act of 1913 specifies ire rope only. Wire strand, for use without forming into wire rope, comparable to the cheaper grades of wire rope only.

The acts previous to that of 1913 provided a duty laid according the rates prescribed for the wire used in the construction of the pe. That of 1883 and 1890 laid a duty of 1 cent per pound in dition to the duty upon the wire on wire rope and strand made of on wire, and 2 cents per pound additional on that made of steel. he act of 1897 laid a duty of 1 cent per pound in addition to the aximum rate on any wire used in the construction of the rope. his is the rate falling upon wire rope and strand by the preceding

and subsequent acts (1894 and 1909), though without a specification of wire rope and strand. (P. 93.)

The duties charged on round wire by the acts preceding that of 1913 were partly specific, partly ad valorem duties, graded according to the gauge of the wire, its value, and finish. (See Survey on Round Iron and Steel Wire, Plain and Galvanized.)

COMPETITIVE CONDITIONS.

American conditions have turned the attention of the manufacturers to the production of a high-quality rope, which may be subjected to severe treatment, to an extent which has not been true of the British manufacturer or the German. The Hazard Manufacturing Co. said, respecting these countries:[1]

> There are about 40 English and about 6 German rope manufacturers. Four or five of the English, and none of the German, are first class. For purpose of importation, only the English need be considered, as the German rope will probably not figure to any extent due to the few factories there and their comparatively small size. Most English ropes are made of basic O. H.[2] wire which is cheaper than acid O. H.[3] Cheap rope will work fairly well in England where engineering practice is very conservative and where sheaves are large, speeds slow, loads moderate, acceleration low, and everything is in favor of the rope; whereas the usage over here has been the reverse, requiring an exceedingly high standard of rope to meet our exacting conditions. Quality of foreign rope has never been equal to the best American product, and it is well known to anyone who has dipped into the export trade that English and German "export quality" is far inferior to their own domestic grade and is simply "made to sell."

On the export market the American rope has a reputation for reliability superior to the British or the German. These markets lie in the regions where logging, mining, and construction is being carried on, as is often the case in new countries. Prior to the war the United States, Great Britain, and Germany were the chief competitors in these new fields, particularly in South America and Africa. In South America, Great Britain and Germany held the bulk of the trade. Of the imports of wire rope into Central America, 66 per cent comes from the United States; of that into Mexico, 80 per cent. The United States also exports into Canada in competition with Canadian and British rope over a 32½ per cent duty, while the British rope is dutiable at only 22½ per cent.[4]

TARIFF QUESTIONS.

The war has brought about the substitution of domestic for foreign wire, which seems a permanent one. The important consideration to-day is the sufficiency of the duty on the rope as against foreign rope rather than the height of the duty necessary to compensate for that on foreign wire.

The Upson-Walter Co. states:[1]

> * * * the wire rope out turn of the wire-rope mills of the United States has been increased about 200 per cent. So that in peace times our labor will have to be paid much lower wages than they are receiving now, so that we can export at least 50 per cent of the wire rope manufactured in this country, or else the tariff wall on this side will have to be high enough, if we continue to pay these high wages, to keep out foreign rope. On the other hand, if such a tariff goes into effect, it would not help us to export, which, in my estimation, would mean that we would operate our mills to about 50 per cent of their capacity.

[1] Questionnaire returned to the Commission October 5, 1918, p. 4.
[2] Open-hearth.
[3] Consular Report on Markets for Wire Rope in Foreign Countries, 1911-1912 (unpublished).
[4] Letter of November 8, 1918, to the Commission.

Drawbacks paid on imported steel wire used in the manufacture of exported wire rope.

	Tons.	Drawback.		Tons.	Drawback.
1910	(1)	(1)	1915	692	$8,292.56
1911	(1)	(1)	1916	270	3,236.47
1912	714	$17,409.23	1917	117	1,040.57
1913	784	19,186.39	1918	3	349.61
1914	843	12,183.13			

[1] Figures not available.

Production in United States of wire rope and strand.

[From Federal Census.]

Years.[1]	Not made in wire-drawing mills.	Made in wire-drawing mills.		Total value.
	Value.	Quantity.	Value.	
		Tons.		
1909	$5,406,923	45,303	$6,683,771	$12,090,694
1914	5,462,786	52,735	7,973,537	13,436,323

[1] Calendar year, or business year most nearly corresponding.

Iron and steel, manufactures of—Wire, and manufactures of—Wire rope—Imports for consumption—Revenue.

Years.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Pounds.*				*Per cent.*
1914 [1]	30 per cent	1,592,481	$87,375.00	$26,212.50	$0.055	30
1914 [2]	Free, Section IV, J 5.	653,682	34,360.00		.053	
1915	30 per cent	1,383,785	74,285.00	22,285.50	.054	30
1915 [2]	Free, Section IV, J 5.	68,047	3,147.00		.046	
1915 [3]	Free, Section IV, J 6.	1,700	162.00		.095	
1916	30 per cent	502,109	46,707.00	14,012.10	.093	30
1916 [2]	Free, Section IV, J 5.	41,468	1,516.00		.035	
1917	30 per cent	414,132	48,696.00	14,608.80	.118	30
1917 [2]	Free, Section IV, J 5.	28,442	2,836.00		.099	
1918	30 per cent	118,837	13,096.00	3,928.80	.110	30
1918 [2]	Free, Section IV, J 5.	19,191	1,893.00		.098	
Calendar year:						
1918	30 per cent	49,996	6,740.00	2,022.00	.135	30
1918	Free, Section IV, J 5.	197,497	18,093.00		.092	
1919	30 per cent	100,932	18,577.00	5,573.10	.184	30
1919 [2]	Free, Section IV, J 5.	7,454	1,487.00		.199	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] For construction and equipment of vessels.
[3] For repairs of vessels.

Wire rope and cables [1]—Domestic exports.

FISCAL YEAR.

Exported to—	1918	Exported to—	1918
France	$1,343,893	Chile	[illegible]
Italy	74,000	Peru	[illegible]
Russia [2]	441,310	Dutch East Indies	[illegible]
Canada	345,635	Australia	[illegible]
Panama	129,909	Philippine Islands	[illegible]
Mexico	120,344	All other	[illegible]
Cuba	259,419		
Argentina	87,061	Total	3,732,[illegible]
Brazil	126,665		

[1] Included in "All other manufactures of wire" prior to 1918.
[2] Includes both Russia in Europe and Russia in Asia.

CALENDAR YEARS.

Exported to—	1918	1919
France	$1,436,151	[illegible]
Italy	426,060	[illegible]
Canada	535,296	[illegible]
Panama	95,751	[illegible]
Mexico	171,362	[illegible]
Cuba	368,604	[illegible]
Argentina	96,140	[illegible]
Brazil	107,246	[illegible]
Chile	400,605	[illegible]
Peru	62,269	[illegible]
China	27,774	[illegible]
British India	34,302	[illegible]
Dutch East Indies	25,149	[illegible]
Hongkong	22,806	[illegible]
Japan	38,103	[illegible]
Australia	31,048	[illegible]
Philippine Islands	125,279	[illegible]
British South Africa	29,964	[illegible]
All other	191,110	[illegible]
Total	4,225,019	4,379,[illegible]

Wire rope and strand—Standard list prices on certain varieties of wire rope and strand.

[From the catalogue of a manufacturer.]

STANDARD IRON HOISTING ROPE.

[6 strands, 19 wires to the strand, 1 hemp core.]

Diameter in inches.	Circumference in inches.	Approximate weight per foot, in pounds.	Approximate strength, in tons of 2,000 pounds.	Proper working load, in tons of 2,000 pounds.	Diameter of drum or sheave, in feet advised.	List price per foot.
2½	8¼	11.95	111	22.2	17	$1.70
2¼	7¼	9.85	92	18.4	15	1.40
2⅛	7⅛	8	72	14.4	14	1.17
2	6⅜	6.30	55	11	12	.95
1⅞	5⅞	5.55	50	10	12	.88
1¾	5½	4.85	41	8.8	11	.80
1⅝	5	4.15	38	7.6	10	.65
1½	4¾	3.55	33	6.6	9	.57
1⅜	4⅜	3	28	5.6	8.5	.49
1¼	4	2.45	22.8	4.56	7.5	.40
1⅛	3¾	2	18.6	3.72	7	.33
1	3	1.58	14.5	2.90	6	.26
⅞	2¾	1.20	11.8	2.36	5.5	.20
¾	2¼	.89	8.5	1.70	4.5	.16
⅝	2	.62	6	1.20	4	.12
½	1½	.50	4.7	.94	3.5	.10
⅜	1⅛	.39	3.9	.78	3	.08½
⅞	1⅛	.30	2.9	.58	2.75	.07½
⅛	1⅛	.22	2.1	.48	2.25	.07
7/16	1	.15	1.5	.30	2	.06½
¼	¾	.10	1.1	.22	1.50	.06½

rope and strand—Standard list prices on certain varieties of wire rope and strand— Continued.

STANDARD CRUCIBLE CAST STEEL HOISTING ROPE.

[6 strands, 19 wires to the strand, 1 hemp core.]

Diameter in inches.	Circumference in inches.	Approximate weight per foot, in pounds.	Approximate strength, in tons of 2,000 pounds.	Proper working load, in tons of 2,000 pounds.	Diameter of drum or sheave, in feet advised.	List price per foot.
2¾	8¼	11.95	211	42.2	11	$2.10
2½	7½	9.85	170	34	10	1.75
2¼	7¼	8	133	26.6	9	1.44
2	6¼	6.30	106	21.2	8	1.16
1¾	5½	5.55	96	19	8	1.02
1¾	5¼	4.85	85	17	7	.90
1⅝	5	4.15	72	14.4	6.5	.77
1½	4¾	3.55	64	12.8	6	.66
1⅜	4¼	3	56	11.2	5.5	.56
1¼	4	2.45	47	9.4	5	.46
1⅛	3½	2	38	7.6	4.5	.38
1	3	1.58	30	6	4	.31
⅞	2¾	1.20	23	4.6	3.5	.24
¾	2¼	.89	17.5	3.5	3	.19
⅝	2	.62	12.5	2.5	2.5	.14
⅝	1¾	.50	10	2	2.25	.12
½	1½	.39	8.4	1.68	2	.11
½	1¼	.30	6.5	1.30	1.75	.10
⅜	1⅛	.22	4.8	.96	1.50	.09½
⅜	1	.15	3.1	.62	1.25	.09¼
¼	¾	.10	2.2	.44	1	.09

STANDARD PLOW STEEL HOISTING ROPE.

[6 strands, 19 wires to the strand, 1 hemp core.]

Diameter in inches.	Circumference in inches.	Approximate weight per foot, in pounds.	Approximate strength, in tons of 2,000 pounds.	Proper working load, in tons of 2,000 pounds.	Diameter of drum or sheave, in feet advised.	List price per foot.
2¾	8¼	11.95	275	55	11	$3.00
2½	7½	9.85	229	46	10	2.50
2¼	7¼	8	186	37	9	2.00
2	6¼	6.3	140	28	8	1.58
1¾	5½	5.55	127	25	8	1.46
1¾	5¼	4.85	112	22	7	1.30
1⅝	5	4.15	94	19	6.5	1.08
1½	4¾	3.55	82	16	6	.93
1⅜	4¼	3	72	14	5.5	.79
1¼	4	2.45	58	12	5	.65
1⅛	3½	2	47	9.4	4.5	.54
1	3	1.58	38	7.6	4	.43
⅞	2¾	1.20	29	5.8	3.5	.34
¾	2¼	.89	23	4.6	3	.26
⅝	2	.62	15.5	3.1	2.5	.19
⅝	1¾	.50	12.3	2.4	2.25	.16
½	1½	.39	10	2	2	.14
½	1¼	.30	8	1.6	1.75	.13
⅜	1⅛	.22	5.75	1.15	1.50	.12½
⅜	1	.15	3.8	.76	1.25	.12¼
¼	¾	.10	2.65	.53	1	.12

e and strand—Stan lard list prices on certain varieties of wire rope and stra
Continued.

GALVANIZED STRAND.

[7 steel wires twisted into a single strand, standard steel strand, galvanized or extra galvanized.]

Diameter, in inches.	Seizing strand trade number.	Approximate weight per 1,000 feet, in pounds.	Approximate strength, in pounds.	List price per 100 feet.
½	.....	800	14,000	$8.50
7/16	.....	650	11,000	7.00
3/8	.....	510	8,500	5.50
5/16	.....	415	6,500	4.50
¼	.....	295	5,000	3.50
7/32	.....	210	3,800	2.75
3/16	.....	125	2,300	1.75
5/32	.....	95	1,800	1.50
1/8	.....	75	1,400	1.25
9/64	.....	55	900	1.15
5/64	18	40	700	1.10
1/16	19	32	500	1.00
1/16	20	25	450	.90
1/16	21	20	400	.80
1/16	22	13	300	.70

UCIBLE CAST STEEL TRANSMISSION, HAULAGE OR STANDING ROPE.

[6 strands, 7 wires to the strand, 1 hemp core.]

Diameter, in inches.	Circumference, in inches.	Approximate weight per foot, in pounds.	Approximate strength, in tons of 2,000 pounds.	Proper working load, in tons of 2,000 pounds.	Diameter of drum or sheave, in feet advised.	List price per foot.
1½	4½	3.55	63	12.6	11	$0.60
1⅜	4¼	3	53	10.6	10	.51
1¼	4	2.45	46	9.2	9	.43
1⅛	3½	2	37	7.4	8	.36
1	3	1.58	31	6.2	7	.29
⅞	2¾	1.20	24	4.8	6	.22½
¾	2¼	.89	18.6	3.7	5	.17
11/16	2¼	.75	15.4	3.1	4½	.14½
⅝	2	.62	13	2.6	4½	.12
9/16	1¾	.50	10	2	4	.10
½	1½	.39	7.7	1.5	3½	.08
7/16	1¼	.30	5.5	1.1	3	.06½
⅜	1⅛	.22	4.6	.92	2½	.05½
5/16	1	.15	3.5	.70	2½	.04½
¼	¾	.12½	2.5	.50	1¾	.04

PLOW STEEL TRANSMISSION, HAULAGE OR STANDING ROPE.

[6 strands, 7 wires to the strand, 1 hemp core.]

Diameter, in inches.	Circumference, in inches.	Approximate weight per foot, in pounds.	Approximate strength, in tons of 2,000 pounds.	Proper working load, in tons of 2,000 pounds.	Diameter of drum or sheave, in feet advised.	List price per foot.
1½	4½	3.55	82	16.4	11	$0.90
1⅜	4¼	3	72	14.4	10	.76
1¼	4	2.45	60	12	9	.62
1⅛	3½	2	47	9.4	8	.51
1	3	1.58	38	7.6	7	.41
⅞	2¾	1.20	31	6.2	6	.32
¾	2¼	.89	23	4.6	5	.24½
11/16	2¼	.75	18	3.6	4½	.21
⅝	2	.62	16	3.2	4½	.17½
9/16	1¾	.50	12	2.4	4	.14½
½	1½	.39	10	2	3½	.11½
7/16	1¼	.30	7	1.4	3	.09
⅜	1⅛	.22	5.9	1.2	2½	.06½
5/16	1	.15	4.4	.88	2½	.06
¼	¾	.12½	3.4	.68	1¾	.05½

COURT AND TREASURY DECISIONS.

Cable composed of individual copper wires was held to come within paragraph 114 as articles composed wholly or in chief value rather than as wire rope (G. A. 8242, T. D. 37955), but rope consisting of a hemp core about which were twisted five strands, each made of a number of wires wound and bound together with hemp or marlin, wire being the component of chief value, was held dutiable as wire rope (G. A. 8136, T. D. 37516; see also T. D. 35300).

Galvanized steel wire rope was held properly classified under paragraph 135 of the act of 1909 at 35 per cent ad valorem, the minimum rate for round iron or steel wire ropes, 1 cent per pound for the finished article, plus 0.2 cent per pound additional for the galvanizing. The only changes in that paragraph as compared with the corresponding provisions of paragraph 137 of the act of 1897 were declared not to require a different construction. (Abstract 24803, T. D. 31300, following G. A. 4761, T. D. 22471.)

Wire rope and strand—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883	182	* * * On iron wire rope and wire strand, 1 cent per pound in addition to the rates imposed on the wire of which it is made. On steel wire rope and wire strand, 2 cents per pound in addition to the rates imposed on the wire of which it is made.	
1890	148	* * * On iron wire rope and wire strand, 1 cent per pound in addition to the rate imposed on the wire of which it is made. On steel wire rope and wire strand, 2 cents per pound in addition to the rate imposed on the wire of which they or either of them are made.	
1894	124	* * * *Provided*, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
1897	137	* * * except that wire rope and wire strand shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture thereof and in addition thereto 1 cent per pound.	
1909	135	* * * *Provided further*, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
1913	114	* * * wire rope	30 per cent ad valorem.

WIRE NAILS AND SPIKES.[1]

Summary table.

[Kegs of 100 pounds.]

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production. Imports.	Ratio to production. Exports.	Value (imports for consumption.)[2]	Amount of duty.[2]	Value per keg of 100 pounds.	Actual or equivalent ad valorem rate.
	Kegs.	*Kegs.*	*Kegs.*	*Per cent.*	*Per cent.*				*Per cent.*
1909	[3]13,926,861	44	.....	0.0003	.....	$206	$24	$4.67	11.37
1910	12,704,902	86	815,313	.0007	6.42	209	37	2.42	17.70
1911	13,437,778	129	1,120,944	.0009	8.34	435	52	3.40	11.90
1912	11,659,700	129	1,109,315	.0009	9.61	723	52	5.60	7.16
1913	13,559,727	63	1,221,392	.0005	9.01	258	26	4.10	9.98
1914	[3]12,886,634	3,276	803,102	.025	6.23	15,009	14	4.62	9.09
1915	14,583,026	4,067	1,242,576	.028	8.52	12,219	.....	3.00	Free.
1916	17,147,665	3,116	2,882,831	.018	16.81	7,828	.....	2.51	Free.
1917	17,010,866	6,850	2,703,374	.0402	16.39	25,800	.....	3.77	Free.
1918	12,279,808	25,719	2,440,698	.21	19.87	135,665	.....	5.27	Free.
1919	13,094,221	52,419	.....	.40	.....	207,228	.....	5.67	Free.
1920	.....	258,893	.....	.....	.....	1,470,752	.....	5.68	Free.

[1] Calendar years.
[2] Fiscal years ending June 30.
[3] Census figure; covers rolling mills and wire mills only.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 554. Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe-nail rods, hob nails, and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs. Free.

DESCRIPTION.

The tariff of 1913 classified nails into cut nails and spikes; horseshoe, hob, and all other wrought-iron and steel nails; wire staples; wire nails; spikes; cut tacks, brads, and sprigs; admitting all of them free. Large wire nails were thus classified as spikes. In ordinary usage a wire spike is a wire nail two inches or more (4 inches long, 0.1620 inch in diameter or larger, or it may be confined to those sixtypenny (6 inches long, 0.2257 inch in diameter or larger." A Treasury decision defines spikes as all nails 3½ inches long, 0.1082 inch in diameter or larger.

[1] Statistics of imports and exports of iron and steel products are given in separate tables. Statistics of imports and exports of wire nails are given in separate tables.
[2] The Coal and Metal Miners' Pocketbook, 1911, p. 111, calls those wire nails spikes which are from 3 inches (20-penny, or 20d. nail) to 6 inches long, and have a shank diameter of 0.162 inch (6-penny, or 6d. nail) to 0.207 inch (20-penny, or 20d. nail), the difference in shank diameter being associated with the same length. All nails under 3 inches in length, all are called "nails."
[3] U. S. Treas. T. D. 1758, Oct. 29, 1896.

DOMESTIC PRODUCTION.

Quantity.—The production of wire nails has been increasing steadily. he yearly report of the American Iron and Steel Institute gives the oduction as 7½ million kegs in 1899, 12 in 1904, 14 in 1909, and 13 1914.[1]

The two years 1915 and 1916 show an increase in production as ie result of war demands. In these years 14½ and 17 million kegs, spectively, were produced. In 1919 the amount was 13,094,221 egs. The census reported the total value of the product in 1914 as 25,007,906.

Manufacture and organization.—Wire nails and spikes are made by utomatic machinery from hard steel wire just as it comes from the rawing dies. This wire is fed into the machine, which forms the ead of the nail upon the end of the wire by the blow of the heading ool. The wire is cut to length by the machine in such a way as to orm the point.

They are now merely one product of the wire industry, made in actories producing also other wire products. Of the total value roduced in 1914 only 6.56 per cent was manufactured outside of ills drawing their own wire; 69 per cent of the value of the product as manufactured in wire department of rolling mills.

The wire industry as a whole is one of large establishments under orporate control. (See Survey of Iron and Steel Wire, Plain and alvanized.)

Localities of production.—In 1914 Pennsylvania led in the annual apacity of its wire-nail machines—8⅞ millions of kegs. Ohio, Illiois, Colorado, Alabama, and Indiana followed, all with an annual apacity of over 1½ millions of kegs. These are, in general, States ontaining a large number of steel works and rolling mills, except for olorado, which had only one in 1914.

History.—The wire nail was used in Europe before it was in the nited States, and there it was at first made by hand. In 1851 the rst wire nails were produced in the United States, but they were not ade in commercial quantities before 1887.[2] The consumption of ire nails has increased from 1,486,586 kegs in 1888 to 11,083,176 egs in 1919, while that of cut nails has decreased from 6,371,985 egs to 329,054.[3]

Raw material and process of manufacture.—The raw material of ire nails is hard-drawn wire which comes to the nail machine in the condition it leaves the wire drawing blocks. This is fed into an automatic machine, which straightens it, stamps the head, and cuts the point. The wire is seized by gripping dies, nd the head formed on the end by the blow of a heading tool. As he header withdraws the wire is pushed forward the length of the ail, and the cutting dies advance from the sides and clip off the ail, forming its point. The ejector disposes of this nail just as he wire behind is advanced to be headed. The nails are cleaned f the lubricant and oil of the drawing process, and of the "whiskers" hich may be left at the point of the nail by the pointing machine,

[1] Census figures for quantity incomplete, except for 1904.
[2] The date which the Statistical Abstract begins quoting prices for wire nails.
[3] American Iron and Steel Institute: Annual Statistical Report.

by being shaken up with sawdust in tumbling barrels. Special finishes may be given nails to meet special needs.

Distribution of the industry.—The distribution of the industry is shown by the annual capacity of the wire-nail machine in the different States. The following table presents these figures.

Annual capacity of the wire-nail machines in the United States in 1914.

	Annual capacity (kegs of 100 pounds).
United States:	23,904,000
Pennsylvania	8,870,000
Ohio	4,579,000
Illinois	3,197,000
Colorado	2,400,000
Alabama	2,010,000
Indiana	1,695,000
Massachusetts	224,000
New York	200,000
Rhode Island	60,000
Connecticut	22,000
New Jersey	2,000
All others	645,000

Domestic consumption.—The following figures for the consumption of wire nails are published in the Annual Statistical Report of the American Iron and Steel Institute for 1919. The percentage which this forms of production has been computed and added.

Date.	Consumption.	Per cent consumed.[1]
	Kegs.	
1910	11,744,607	92.44
1911	12,236,821	91.08
1912	13,129,347	93.56
1913	12,582,250	92.79
1914	12,323,647	93.54
1915	12,531,551	45.93
1916	13,783,789	61.35
1917	14,466,612	54.99
1918	10,516,340	93.64
1919	11,083,176	94.66

[1] Computed.

The last few years show a marked decrease in the percentage which consumption forms of domestic production, caused by large exports to Europe.

Exports.—Exports of wire nails and spikes varied from 800,000 to 1,400,000 kegs from 1910 to 1914. In 1919 the amount was 2,011,000 kegs. Before the war the bulk of this export went to Japan, the United Kingdom, China, and British India. In 1914, Europe took only 128,000 kegs; in 1915, 539,000; in 1916, 970,000; and in 1917, 1,169,000. In 1917 this formed 40 per cent of the export. In 1919 the total amount taken by Europe had decreased to 459,000 kegs.

IMPORTS.

Character.—Imports have been persistent but small. Since the act of 1913 admitted wire nails free, there has been a decided increase, but up to 1917 annual imports had not equaled an amount greater than 0.03 per cent of the domestic production. For the years 1914–1917 the average import was 4,320 kegs; for the three preceding, only 107. In 1919 the annual import had increased to 52,419 kegs, equal to 0.4 per cent of the production, and in 1920 to 258,993 kegs.

Revenue.—The amount of revenue derived from the duty on wire nails was small under the act of 1909. The highest revenue collected in any one year from 1909 to 1914 was only $52. During these years the ad valorem equivalent of the specific rates varied from 10 to 18 per cent. Under the preceding act (1897), from 1898 to 1908, the average yearly revenue was $121.55.

PRICES.

In 1910, the price of wire nails varied between $1.70 and $1.85 per keg. It reached its lowest in 1914, when it stood at from $1.50 to $1.60 per keg. Since the war it has increased, reaching $4 in 1917. On November 6 of that year the price was adjusted at $3.50 per keg.

TARIFF HISTORY.

Paragraph 554 of the act of 1913 admits wire nails of wrought iron or steel free.

The act of 1890 was the first to specify wire nails. It placed on them a specific duty of 2, 2½, or 4 cents per pound, according to length and gauge of wire of which they were made. An ad valorem duty of 25 per cent was laid by the act of 1894. Specific duties were again resorted to in the acts of 1897 and 1909, lighter than those of the act of 1890.

TARIFF QUESTIONS.

Wire nails have not been made the subject of recommendation before the Ways and Means Committee separately from other wire products.

Wire nails—Production in United States.

[Kegs of 100 pounds.]

[From American Iron and Steel Institute, Annual Statistical Report.]

Calendar year.	Kegs.	Calendar year.	Kegs.
1900	7,233,979	1910	12,704,902
1901	9,803,822	1911	13,437,778
1902	10,982,246	1912	14,659,700
1903	9,631,661	1913	13,559,727
1904	11,926,661	1914	13,132,814
1905	10,854,892	1915	14,583,026
1906	11,486,647	1916	17,147,665
1907	11,731,044	1917	17,040,666
1908	10,662,972	1918	12,279,800
1909	13,916,053	1919	13,094,221

Wire nails and spikes produced in the United States.

[From Federal Census.]

Made in—	Quantity.			
	1899	1904	1909	1914
	Kegs.	*Kegs.*	*Kegs.*	*Kegs.*
Rolling mills	4,495,011	9,081,512		
Wire mills and wire departments of rolling mills			13,936,861	12,88[illegible]
	Value.			
Rolling mills	$12,445,096	$17,495,362		
Wire mills not rolling mills	2,787,159	4,017,830		
Wire mills and wire departments of rolling mills			$27,575,774	$23,38[illegible]
Establishments whose chief product is wire nails		(1)		1,39[illegible]
Other establishments		2,787,159		30[illegible]
Total value	15,232,255	24,300,351	27,575,774	25,08[illegible]

[1] Included in "Other establishments."

Imports for consumption—Revenue.

SPIKES.[1]

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1 cent per pound	31,892	$738	$319	$0.023	43.2[illegible]
1908	do	3,006	77	30	.025	39.0[illegible]
1909	do	11,425	359	114	.031	31.7[illegible]
1910	do	5,210	105	52	.020	49.5[illegible]
1910	½ cent per pound	12,725	467	95	.037	20.3[illegible]
1911	do	17,837	353	133	.019	37.6[illegible]
1912	do	19,926	630	149	.031	24.1[illegible]
1913	do	32,763	996	245	.029	24.5[illegible]
1914	do	8,012	272	60	.034	22.0[illegible]
1914	Free	35,716	797		.022	
1915	do	45,087	1,077		.024	
1916	do	15,009	374		.025	
1917	do	25,353	696		.027	
1918	do	683,326	19,525		.029	
1919	do	145,510	5,419		.037	
1920	do	102,957	3,886		.038	

WIRE NAILS MADE OF WROUGHT IRON OR STEEL.[2]

		Pounds.				*Per cent.*
1907	½ cent per pound	53,479	$3,288	$267	$0.061	8.1[illegible]
1908	do	10,550	669	52	.063	7.7[illegible]
1909	do	4,178	181	20	.043	11.0[illegible]
1910	⅓ cent per pound	7,854	159	31	.020	19.4[illegible]
1911	do	12,525	388	50	.031	12.8[illegible]
1912	do	12,741	700	50	.055	7.1[illegible]
1913	do	6,234	236	24	.038	10.1[illegible]
1914	do	933	26	3	.029	12.9[illegible]
1914	Free	322,258	14,940		.046	
1915	do	406,713	12,219		.030	
1916	do	311,606	7,828		.025	
1917	do	685,019	25,800		.038	
1918	do	2,574,874	135,685		.053	
1919	do	5,241,893	297,228		.057	
1920	do	25,899,260	1,470,752		.057	

[1] Of wrought iron or steel prior to Oct. 4, 1913.
[2] Given under "less than 1 inch in length and lighter than No. 16 wire gauge prior to act of Oct. 3, 1913."

Imports for consumption—Revenue—Continued.

WIRE NAILS MADE OF WROUGHT IRON OR STEEL[1]—Continued.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
[illegible]	1 cent per pound	1,603	$79	$16	$0.049	20.29
[illegible]	½ cent per pound	264	25	2	.095	10.56
[illegible]	do	794	49	5	.062	12.02
[illegible]	do	270	46	2	.170	4.41
[illegible]	do	110	23	----------	.209	----------
[illegible]	do	113	22	----------	.197	----------
[illegible]	do	1,422	42	10	.029	25.38

[1] Given under "less than 1 inch in length and lighter than No. 16 wire gauge prior to act of Oct. 3, 1913."

Wire nails and spikes—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
[illegible]pan	33,094,672	$651,872	50,010,111	$1,035,272	66,150,458	$1,308,987
[illegible]ited Kingdom	8,778,314	178,664	10,167,699	202,642	14,928,276	292,785
[illegible]na[1]	10,961,920	224,172	14,824,769	301,660	8,980,842	184,194
[illegible]tish India	714,266	15,052	3,400,603	67,863	8,709,492	175,569
[illegible]uth East Indies	2,040,153	42,847	3,355,395	80,894	6,752,358	142,402
[illegible]w Zealand	3,194,369	66,989	7,311,942	146,272	5,988,094	121,722
[illegible]ilippine	2,943,955	70,849	2,314,566	55,632	4,278,098	103,179
[illegible] other	19,803,631	454,581	20,709,267	474,436	25,143,930	537,142
Total	81,531,280	1,705,026	112,094,352	2,364,671	140,931,548	2,865,980

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
[illegible]pan	18,954,128	$352,262	8,518,760	$167,227	3,051,728	$66,026
[illegible]ited Kingdom	19,035,547	378,148	12,628,376	238,765	53,110,972	1,029,594
[illegible]na[1]	18,910,687	401,116	9,576,682	206,427	10,655,956	198,116
[illegible]ritish India	13,013,699	268,128	4,163,173	84,715	7,563,240	153,235
[illegible]uth East Indies	7,056,836	155,704	7,758,216	180,656	5,564,430	111,366
[illegible]w Zealand	6,089,384	114,649	4,552,849	88,100	4,000,425	70,215
[illegible]ilippines	4,761,880	108,632	5,094,917	123,537	4,199,654	84,430
[illegible] other	34,317,047	742,911	28,017,208	604,205	[3] 36,111,195	[3] 763,555
Total	122,139,208	2,521,550	80,310,181	1,693,632	124,257,600	2,476,537

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
[illegible]pan	45,335,407	$1,200,451	35,541,314	$1,241,883	36,381,442	$1,935,109
[illegible]ited Kingdom	93,131,596	2,172,285	88,907,709	3,295,496	63,781,905	3,061,871
[illegible]na[1]	20,625,707	583,003	20,328,121	807,860	20,607,294	1,068,822
[illegible]ritish India	19,254,387	458,702	13,174,242	546,783	14,404,939	831,099
[illegible]uth East Indies	11,873,180	277,859	7,722,506	304,415	12,325,393	578,447
[illegible]w Zealand	2,647,372	63,376	2,560,090	101,198	1,436,290	73,097
[illegible]ilippines	8,035,649	208,806	2,511,297	122,767	8,795,495	495,186
[illegible] other	[4] 87,379,839	[4] 2,402,992	[5] 108,592,131	[5] 4,290,654	86,276,509	4,521,302
Total	288,283,137	7,367,474	279,337,410	10,711,056	244,009,767	12,564,933

[1] Exclusive of leased territory.
[3] France, 468 pounds, 1914; none 1915. Russia 700 pounds, 1914; 208,854 pounds, 1915.
[4] France, 2,650,250 pounds, 1916; 22,400,919 pounds, 1917; 7,976,371 pounds, 1918. Russia, 2,795,616 pounds, 1916; 3,320,332 pounds, 1917; 2,642,158 pounds, 1918.

Wire nails—Domestic exports (calendar years).

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
France	5,000,817	$294,255	15,032,988	$
Greece	893,143	60,130	2,078,868	
England	22,200,384	1,137,259	23,810,077	1,
Canada	8,399,587	359,940	2,444,397	
Mexico	2,571,560	150,494	3,404,476	
Cuba	5,731,587	292,796	8,166,806	
Argentina	1,621,255	97,269	4,197,356	
Chile	2,695,387	183,983	1,652,588	
China	10,596,993	590,923	20,255,210	
British India	14,075,829	848,929	15,372,290	
British Straits Settlements	5,900,475	336,690	6,088,632	
Dutch East Indies	8,322,224	438,254	12,963,306	
Hongkong	14,759,661	848,963	4,932,154	
Japan	39,362,292	2,289,156	36,324,064	1,
Australia	3,254,124	202,873	2,896,469	
New Zealand	1,432,536	82,964	3,504,772	
Philippines	6,731,622	377,690	5,341,478	
British South Africa	3,405,073	199,187	5,802,477	
All other	19,371,496	1,129,368	26,836,093	1,
Total	176,346,045	9,921,123	201,104,501	10,

Wire nails—Prices, Pittsburgh, per keg, 100 pounds.

[From Metal Statistics.]

Year.	High.	Low.	Year.	High.	L
	Dollars.	*Dollars.*		*Dollars.*	D
1910	1.85	1.70	1915	2.10	
1911	1.80	1.50	1916	3.00	
1912	1.75	1.55	1917 [1]	4.00	
1913	1.80	1.50	1918	3.50	
1914	1.60	1.50	1919	3.50	

[1] Nov. 13, 1917, adjusted price $3.50.

NOTE.—Weekly and monthly prices are given in the Iron Age and the Iron Trade Review; daily
American Metal Market and Daily Iron and Steel Report.

Wire nails, eight penny—Prices, Pittsburgh, per 100-pound keg.

[From War Industries Board, Division of Planning and Statistics, Price Section. Price Fixing
No. 5, November, 1918. Market Prices of Commodities under Control—Iron and Steel. Based on
of Labor. Statistics from Hardware Age.]

1913	$1.82	1916	
1914	1.68	1917	
1915	1.74	1918	

COURT AND TREASURY DECISIONS.

Under the Revised Statutes, when nails were not specifi
provided for, iron wire nails were classified as manufactures of
under Schedule E and not by assimilation as wrought-iron n
(Dept. Order, T. D. 3922.)

Brass-headed nails, commercially known as "brass nails," "
niture nails," and "upholsterers' nails," were held dutiable
manufactures of metal under the act of 1883 and not as wro
iron or steel nails, nor as plated or gilt articles. (Appeal, T.
6361.)

So-called iron or steel nails which, however, were returned by
appraiser as not nails of any kind but manufactures of iron us
button material, were held dutiable as manufactures of metal u
the act of 1883. (Dept. Order, T. D. 6397.)

Bellows nails with heads about five-eighths of an inch in diam-
er, were held dutiable, as wrought-iron nails under the act of 1883
d not as malleable iron castings. (Appeal, T. D. 7257.)

Small pieces of steel of different sizes and various patterns, such
rosettes, stars, and arrows, each having an iron shank, and com-
ercially known as "steel points," were held dutiable as manufac-
res of metal and not under the provision for "cut nails or spikes
iron or steel" in the act of 1883, because used in the manufac-
re of buttons, cheap jewelry, etc., and not as nails. (Appeal, T.
. 7659.)

Nails of white porcelain (glazed) tops or heads, porcelain chief
lue, were held dutiable under the provision for "all other earthen,
one, and crockery ware, white glazed or edged, composed of earthy
mineral substances, not specially enumerated or provided for"
55 per cent ad valorem, and not as a manufacture wholly or in
rt of metal at 45 per cent under paragraph 216 of the act of 1883.
ppeal, T. D. 8066.)

So-called "wire nails," commercially known as "wig points,"
re held dutiable as manufactures of metal and not as nails under
e act of 1883. (Appeal, T. D. 8824.)

Small nails with large brass heads, used in upholstering furniture,
re held dutiable as manufactures of metal under the act of 1883,
d gilt nails with larger heads in fancy shapes, such as crosses,
ur de lis, and imitation roses, were held dutiable as gilt articles
der that act. (Berbecker *v.* Robertson, 152 U. S. 373; T. D.
48.)

Horseshoe nail blanks, requiring to be scalded, cold-rolled and
ed of surplus metal by dies and pointed, were held dutiable as
anufactures of metal and not by similitude as horseshoe nails,
der the act of 1890. (G. A. 1622; T. D. 13201.)

Furniture nails, not shown by the evidence to be of wrought iron
steel, but shown to be in chief value of leather, were held duti-
le under the provision for leather in paragraph 452 of the act of
09. (Richard *v.* U. S., 4 Ct. Cust. Appls. 252.)

Wire nails—Rates of duty.

of—	Par.	Tariff classification or description.	Rate of duty, specific and ad valorem.
83	.....	Not specified.....	
90	175	Wire nails made of wrought iron or steel:	
		2 inches long and longer, not lighter than No. 12 wire gauge..	2 cents per pound.
		From 1 inch to 2 inches in length, and lighter than No. 12 and not lighter than No. 16 wire gauge.	2½ cents per pound.
		Shorter than 1 inch and lighter than No. 16 wire gauge.....	4 cents per pound.
94	147	Wire nails made of wrought iron or steel.....	25 per cent ad valorem.
97	162	Wire nails made of wrought iron or steel:	
		Not less than 1 inch in length and not lighter than No. 16 wire gauge.	½ cent per pound.
		Less than 1 inch in length and lighter than No. 16 wire gauge..	1 cent per pound.
09	161	Wire nails made of wrought iron or steel:	
		Not less than 1 inch in length and not lighter than No. 16 wire gauge.	$\frac{1}{10}$ cent per pound.
		Less than 1 inch in length and lighter than No. 16 wire gauge..	¼ cent per pound.
13	554	Cut nails and cut spikes of iron or steel, horseshoe nails, horse-shoe-nail rods, hobnails and all other wrought-iron or steel nails not especially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes of iron or steel, and cut tacks, brads, or sprigs.	Free.

Spikes—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rate of duty, s and ad valor
1883	162	Wrought iron or steel spikes, nuts, and washers, and horse, mule, or ox shoes.	2 cents per pou
1890	176	Spikes, nuts, and washers, and horse, mule, or ox shoes, of wrought iron or steel.	1-7/8 cents per p
1894	148	.....do.....	25 per cent ad v
1897	163	.....do.....	1 cent per poun
1909	162	.....do.....	½ cent per poun
1913	554	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe-nail rods, hobnails and all other wrought iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs.	Free.

CUT NAILS AND SPIKES.

Summary table.

[Kegs of 100 pounds.]

Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.		Value[2] (imports for consumption.)	Amount of duty.[2]	Value per pound.	Actual or equivalent ad valorem rate.
			Imports.	Exports.				
Kegs.	*Kegs.*	*Kegs.*	*Per cent.*	*Per cent.*				*Per cent.*
[3] 1,009,319	471	179,508	0.05	17.78	$1,321	$283	$0.028	21.41
1,005,233	378	197,493	.04	19.64	877	155	.019	17.71
967,636	415	228,539	.04	23.62	1,176	166	.026	14.12
978,415	160	276,697	.02	28.28	474	64	.030	13.54
842,038	66	107,642	.01	12.78	225	26	.034	11.73
[3] 740,436	1,428	101,360	.19	13.69	3,523	22	.025	.63
775,327	214	59,198	.03	7.63	536	Free.	.025	.....
764,835	51	99,126	.01	12.96	154	Free.	.030	.....
461,674	838	103,158	.018	22.34	2,526	Free.	.030	.....
418,811	2,944	116,406	.07	27.79	16,460	Free.	.056	.....
394,477	6,057	77,647	1.54	19.68	32,680	Free.	.054	.....
.....	20,330	40,514	.....	.....	109,059	Free.	.053	.....

ndar years.
al years ending June 30.
as figure; product of rolling mills only.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

. Cut nails and cut spikes of iron or steel, horseshoe nails, shoe-nail rods, hobnails, and all other wrought iron or steel nails pecially provided for in this section; wire staples, wire nails of wrought iron or steel, spikes, and horse, mule, or ox shoes, of or steel, and cut tacks, brads, or springs, free.

DESCRIPTION.

; nails and spikes are classed together under the tariff acts, and e statistics in Commerce and Navigation. The distinction is y one of size, the method of manufacture differing only slightly.

DOMESTIC PRODUCTION.

e manufacture of cut nails is a declining industry in the United s. In 1904 1,311,549 kegs of 100 pounds each, valued at 4,180, were made in the rolling mills of the country. The pro- on in 1909 was approximately 300,000 kegs less, and in 1914 it leclined to 740,436 kegs, valued at $1,469,780. To this may be l the value of the product of establishments other than rolling $1,752,394, making a total of $3,222,174. The decline in the ıction of the cut nail represents the decline in its use, due to the ısing use of the wire nail.

Process of manufacture.—A machine to manufacture iron nails
invented in this country in 1786. The first steel nail was mad
1883, about the time that the wire nail was becoming import
commercially.

Cut nails are manufactured from nail plates of iron or steel. T
have been rolled to the required thickness, and then cut across t
length in widths slightly greater than the length of the nail to
made. These pieces are fed at a black heat to a machine which
them across the end into nail blanks. The cut is made at a sl
angle, and the strip turned over each time, so that these blanks
slightly tapering. The hot blank is seized and headed immedia
in the machine and the finished nail ejected. Another metho
forming the taper, used in the case of the larger sizes, is to have
strip rolled with one edge thicker than the other. It can then be
at right angles, and the turning of the strip done away with.

The amount of nail and tack plate manufactured in the rol
mills has decreased steadily. In 1904 the product was 86,601
tons, valued at $2,462,076; in 1914 it was only 50,302 long t
valued at $2,008,308.

Localities of production.—In 1914 cut nails were manufacture
Pennsylvania, Indiana, Kentucky, Massachusetts, and West Virgi

Domestic consumption.—The consumption of cut nails, as give
the annual statistical report of the American Iron and Steel Instit
is as follows. The percentage which this consumption forms of
amount produced has been computed and added.

Year.	Consumption.	Percentage consumption to production.	Year.	Consumption.	Perc... consu... tion ... produ...
	Kegs.			*Kegs.*	
1910	823,146	81.9	1915	680,449	
1911	711,782	73.6	1916	658,384	
1912	769,847	78.7	1917	360,312	
1913	757,153	89.9	1918	333,143	
1914	692,989	90.0	1919	329,054	

Exports.—The percentage of the production exported has va
from 21.3 per cent in 1912 to 12.2 per cent in 1915. The bul
this export normally goes to North and South America. In
fiscal year 1913 Europe took only 279 kegs,[1] while in 1916 it
ported from the United States 12,805 kegs, 13 per cent of the t
export. In 1919 the amount was 3,356 kegs, or 5 per cent of
total export.

IMPORTS.

Imports have been small, varying from 51 to 1,428 kegs,[1] 19
1916, and never amounting to over 0.2 of the production. The r
nue under the act of 1909 averaged slightly over $100 per year,
lected on a specific duty equivalent to 14.7 per cent on the t
import under the act.

[1] Assuming keg as 100-pound unit.

PRICES.

1910 the price of cut nails per 100-pound keg at Philadelphia $2.10. The following years show a lower price, the lowest being), reached in 1914. Prices increased after this year until ad- d by the Government at $4 per keg. For the last quarter of this price was raised to $5.

TARIFF HISTORY.

t nails and spikes have been specified in the tariff acts since 1883. luty upon them has been specific, except under the act of 1894, it was 22½ per cent ad valorem. It has been decreased from nts per pound in the act of 1883 to 0.4 cent per pound in that of They are free under the act of 1913.

Production in the United States of cut nails and spikes.

[From Federal Census.]

Calendar year.	Made in—				
	Rolling mills.		Establishments whose chief product is cut nails.	Other establishments.	Total (all establishments).
	Kegs.				
	1,658,433	$3,292,062			$3,292,062
	1,311,549	2,394,108			2,394,108
	1,009,319	2,218,207			2,218,207
	740,436	1,469,780	$1,735,979	$16,415	3,222,174

[From American Iron and Steel Institute, Annual Statistical Report.]

Calendar year—	Kegs of 100 pounds.	Calendar year—	Kegs of 100 pounds.
	1,573,494	1910	1,005,233
	1,542,240	1911	967,636
	1,633,762	1912	978,415
	1,435,893	1913	842,038
	1,283,362	1914	769,665
	1,357,549	1915	775,327
	1,189,239	1916	764,835
	1,109,138	1917	461,674
	956,182	1918	418,811
	1,207,597	1919	394,477

Cut nails and cut spikes of iron or steel—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound value rate.
		Pounds.				*Per cent.*
1907	½ cent per pound	61,169	$1,792	$367		
1908	do	47,268	1,258	283	$0.027	
1909	do	47,128	1,321	292	.028	
1910	do	2,063	72	12	.035	
1910	¼ cent per pound	35,733	805	142	.023	
1911	do	41,514	1,176	166	.028	
1912	do	16,049	474	64	.029	
1913	do	6,598	225	26	.034	
1914	do	5,552	184	22	.033	
1914	Free	137,232	3,339		.024	
1915	do	21,358	596		.028	
1916	do	5,141	154		.030	
1917	do	83,915	2,526		.030	
1918	do	294,430	16,460		.056	
1919	do	605,680	32,680		.054	
1920	do	2,032,959	109,059		.053	

Cut nails and spikes—Domestic exports.

FISCAL YEARS.

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
Chile	5,830,452	$114,644	6,177,683	$114,636	6,915,310	$139,[illegible]
Cuba	2,509,060	50,736	5,213,958	102,559	2,466,326	44,[illegible]
Mexico	4,324,337	94,947	2,880,054	57,730	1,631,336	35,[illegible]
Canada	2,195,173	39,085	3,709,902	56,034	10,830,100	139,[illegible]
Panama	541,692	11,105	1,509,462	28,540	1,782,729	36,[illegible]
Australia	500,523	12,482	421,390	10,567	487,399	12,[illegible]
All other	3,768,041	84,905	2,941,600	66,722	3,545,521	79,[illegible]
Total	19,749,278	407,904	22,853,949	434,788	27,669,721	472,[illegible]

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Chile	5,105,182	$91,089	5,775,023	$105,249	2,619,107	$30,[illegible]
Cuba	1,700,797	31,589	1,333,863	24,983	909,469	15,[illegible]
Mexico	1,560,002	29,382	406,916	8,144	103,979	2,[illegible]
Canada	16,691	488	42,658	932		
Panama	90,813	1,768	266,405	4,846	64,860	1,[illegible]
Australia	331,513	7,458	458,646	9,818	172,575	3,[illegible]
All other	1,950,230	41,498	1,852,519	37,417	2,140,827	41,[illegible]
Total	10,764,228	203,272	10,136,030	191,389	5,919,817	115,[illegible]

Exported to—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
Chile	2,823,777	$58,377	3,832,758	$115,241	4,199,543	$190,[illegible]
Cuba	1,515,889	33,640	1,220,031	39,420	2,241,259	108,[illegible]
Mexico	555,262	13,246	185,965	7,944	190,719	10,[illegible]
Canada	13,338	420	73,465	3,283	447,769	19,[illegible]
Panama	42,582	1,005	2,374	122	5,399	[illegible]
Australia	518,521	10,968	49,120	2,303	37,071	2,[illegible]
All other	[1] 4,443,191	[1] 110,477	[1] 4,952,105	[1] 178,819	4,518,822	215,[illegible]
Total	9,912,563	228,133	10,315,818	347,132	11,640,582	552,[illegible]

[1] Increase general. Exports to Europe: 1913, 29,729 pounds; 1914, 283,954 pounds; 1915, 179,741 pounds; 1916, 1,280,490 pounds; 1917, 2,284,097 pounds. Exports to Europe went principally to France, Italy, Norway, Russia, Spain, and the United Kingdom.

Cut nails and spikes—Domestic exports—Continued.

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
)....	245,878	$10,395	81,150	$8,606
ad....	428,419	21,438	85,988	6,999
a....	94,599	5,676	135,570	7,259
ia....	3,400	300	133,353	5,874
)....	238,024	14,519	434,720	31,065
....	1,788,278	94,276	1,310,045	67,139
....	63,326	3,551	160,235	9,617
ina....	11,000	1,435	230,577	14,772
....	31,165	2,485	185,396	9,814
....	3,330,623	161,670	1,089,399	67,049
ay....	151,100	6,828	176,921	13,694
....	265,477	10,980	630,557	33,000
India....	580,278	32,133	247,635	16,425
East Indies....	136,672	6,187	132,272	7,516
ong....	18,500	1,528	81,355	5,166
....	93,810	7,453	278,010	11,704
lia....	29,520	1,975	111,013	10,989
aland....	578,458	27,930	162,956	8,650
South Africa....	22,102	1,946	114,706	8,775
er....	456,122	27,576	760,483	49,221
Total....	8,566,751	440,281	6,542,341	393,284

t nails—Average prices (wholesale or retail)—Per 100-pound keg at Philadelphia.

[From American Iron and Steel Institute, Annual Statistical Report.]

....	$2.10	1915....	$1.94
....	2.02	1916....	2.96
....	1.92	1917....	[1] 4.50
....	1.99	1918....	[1] 5.19
....	1.90	1919....	5.69

[1] Adjusted price.

kly prices are given in the Iron Trade Review; monthly in the Iron Age and the Annual Statistical t of the American Iron and Steel Institute.

Cut nails and spikes—Rates of duty.

—	Par.	Tariff classification or description.	Rates of duty specific and ad valorem.
	158	Cut nails and spikes of iron or steel....	1¼ cents per pound.
	173	Cut nails and cut spikes of iron or steel....	1 cent per pound.
	145	.....do....	22½ per cent ad valorem.
	160	.....do....	3/16 cent per pound.
	159	Cut nails and cut spikes of iron and steel....	3/16 cent per pound.
	554	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe-nail rods, hobnails, and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs.	Free.

FORGED SPIKES.

Summary table.

[Kegs of 200 pounds.]

Year.	Domestic production.[1]	Imports for consumption.[2, 3]	Domestic exports.[4, 3]	Ratio to production.		Value (imports for consumption).[3, 2]	Amount of duty.[3]	Value per pound.	Ad val. equivalent of value rate.
				Imports.	Exports.[4]				
	Kegs.	*Kegs.*	*Kegs.*	*Per cent.*	*Per cent.*				*Per cent.*
1910		90				$572	$148	$0.032	25.9
1911		89				353	134	.019	37.9
1912		100				620	149	.031	24.0
1913		164	149,876			966	246	.029	25.4
1914	[5]1,389,145	219	97,823	0.02	7.04	1,069	60	.024	5.6
1915		225	61,446			1,077		.024	
1916		75	295,729			374		.025	
1917		127	214,050			686		.027	
1918		3,417	174,161			19,525		.029	
1919		728	232,423			5,419		.037	
1920		515	192,549			3,886		.038	

[1] Calendar years.
[2] Specified as "spikes of wrought iron or steel" Oct. 4, 1913; after that date as "spikes."
[3] Fiscal years ending June 30.
[4] Railroad spikes only.
[5] Only those produced in rolling mills. A sum of the production of "railroad track spikes" plus "forged nails and spikes, other than railroad spikes."

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

554. Cut nails and cut spikes of iron or steel, horse shoenails, horseshoe nail rods, hob nails, and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs, free.

DESCRIPTION.

A forged spike is a large metal nail produced from a bar by a forging machine, or by forging on an anvil.

Railroad-track spikes form the bulk of the forged spikes manufactured in the United States. In 1914, 96.7 per cent of all the forged spikes manufactured in rolling mills were of this kind. Forged spikes are also made for use in the construction of docks and ships, and wherever heavy timbers have to be fastened and for some reason bolts or wire spikes are unusable. Such spikes are forged to the size and shape best fitted for the work.

The railroad-track spike has been largely standardized. It has a shank of square cross section, a chisel-shaped point, and a head in the shape of an irregular oval. The angle which the bearing surface of the head forms with the shank corresponds to that of the flange of the rail. The standard lengths are 5, 5½, and 6 inches, the cross section varying from nine-sixteenths to five-eighths inch.

There are other forms of railroad-track spikes. The screw spike is much used on the European railroads. It has been favorably reported

y the Lackawanna Railroad, but has been found impracticable Pennsylvania. The large exports to Russia in 1915 and 1916 f the so-called "dog-eared" spike, made in accordance to n specifications. Its name comes from the appearance of the f the spike, which is especially formed to make easy drawing e. A number of them are being tried out in the United States. forged spike comes under the tariff classification, "spikes." lso includes wire spikes. (See Survey on Wire Nails and)

DOMESTIC PRODUCTION.

914 the census first published the production of forged spikes. sified them as railroad spikes and other forged spikes. Of the the rolling mills produced 45,936 kegs (100 pounds each), at $92,783.

e classes of establishments made railroad spikes in some quan- olling mills, manufacturers of bolts, nuts, washers, and rivets tablishments whose chief product was "nails and spikes (includ- ks) other than cut and wire." In 1914 the rolling mills pro- 1,366,177 kegs (200 pounds each) of railroad spikes, valued at ,388. The railroad spikes made by the manufacturers of bolts, washers, and rivets were valued at $6,011. Those made by shments whose chief product was "nails and spikes (including other than cut or wire" were not separately specified, but were ed under the total value of their product, $4,128,189.

value of the total production for 1914 was thus $4,201,388 ad spikes made in rolling mills) plus $92,783 (other forged spikes ed in rolling mills), plus $6,011 (railroad spikes made by manu- rs of bolts, nuts, washers, and rivets) equals $4,300,182; and, tion, that portion of the product ($4,128,189) of establishments chief product was nails and spikes (including tacks) other ut and wire, which was made up of forged spikes. Since the ure embraces all cut tacks, horseshoe nails, cobblers' nails, ut a small portion of it could have been made up of forged The figure for the production of forged spikes, as arrived ve, $4,300,182, thus is only slightly less than the total value of hine-made forged spikes.

ess of manufacture.—Railroad-track spikes may be made of iron or steel. Charles E. Slyke, of the Inland Steel Co., states ey are made of basic open-hearth steel, of 0.15 to 0.24 per cent , 0.45 to 0.50 per cent manganese, 0.05 per cent phosphorus, and lphur.[1] This material comes in the form of square bars, cut foot lengths, one sixty-fourth inch larger than the shank of the

e bars are heated by being passed through a furnace. As they rom the furnace, a laborer with a pair of tongs passes them to a machine, which shears, points, and heads them. They are oled and packed.

ed spikes are easily made from bar iron or steel on the anvil and en so made when only a few are required. The factory produc- not specialized, but is carried on in mills making other iron and roducts, and is not a separate industry.

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[1] ge, Sept. 6, 1917, p. 536.

Location of industry.—The principal producing States in 1914 were Pennsylvania, Ohio, New York, New Jersey, and Illinois—States containing 312 of the 427 steel works and rolling mills reported by the census of 1914.

Domestic production and consumption.—In 1914 consumption [1] may be valued at $4,042,000, as compared with a production valued at $4,300,000. Domestic consumption would thus be approximately 94 per cent of the value produced.

Domestic exports.—Export figures cover only the export of railroad-track spikes, which have been recorded only since 1913. The average export, 1913–1915, was 103,048 kegs, valued at $370,632. Of these approximately 60 per cent went to Canada, Cuba, and Mexico. In 1916, 295,729 kegs were exported, valued at $1,398,514, and in 1917 214,050 kegs, valued at $1,502,430. This large increase was caused by war demands. In 1913 and 1914 there were no exports to Europe, while in 1917 they formed 30.3 per cent of the total export.

IMPORTS.

Imports have been continuous but small. The average yearly import for the fiscal years 1910–1914 was 132 kegs of 200 pounds each, and that for 1915–1917, 142 kegs. The latter amount is slightly more than 2 per cent of the 1914 production.

The revenue derived from spikes under the act of 1909 (Aug. 6, 1909, to Oct. 3, 1913) was $684.49, an average duty of approximately $170 per year, at a rate equivalent to 25 per cent ad valorem.

PRICES.

In 1910 the price of standard railroad-track spikes at Pittsburgh was $1.61 per 100 pounds. In the following years prices varied irregularly, reaching their lowest—$1.42 per 100 pounds—in 1914. The war brought a great increase in price, which was finally stopped by the adjustment of the price at $3.90 per 100 pounds for steel track spikes and $4.50 for iron. The adjusted price for boat spikes was $5.25.

TARIFF HISTORY.

United States.—The act of 1913 admits spikes free of duty under paragraph 554. Under previous acts they had been dutiable. That of 1883 laid a duty of 2 cents per pound on wrought-iron or steel spikes. The following act (1890) reduced this duty to $1\frac{4}{5}$ cents per pound. In 1894 the duty was made ad valorem at 25 per cent. The next act (1897) restored a specific duty, with a rate of 1 cent a pound. This the act of 1909 reduced to three-fourths cent.

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[1] Production plus imports for consumption for year ended Dec. 31, 1914, minus domestic exports for year ended Dec. 31, 1914: $4,300,182+$1,116−$258,808=$4,042,490.

In 1914 imports were designated as "spikes of wrought iron or steel" and "spikes," exports as "railroad-track spikes," and production as "forged spikes" produced in rolling mills and railroad spikes produced by the manufacturers of bolts, nuts, washers, and rivets. An estimate for consumption derived from such figures is necessarily rough, because of the lack of agreement in the articles included under these classifications, in addition to the inaccuracy involved in a calculation not taking into account goods in warehouse.

EXPORTS UNDER WAR CONDITIONS.

)13 and 1914 there were no railroad-track spikes exported to). Over one-half of the total export of the United States in the these years went to Canada, Mexico, and Cuba. Export to) began in 1915, and in 1916 Russia took 211,403 kegs[a] of the xport of 295,729. In 1917 increases were general, except to . Europe took 30.3 per cent of the total export, while the to North and South America and Africa showed an increase ıe preceding year.

Production of forged spikes in the United States.

[From Federal Census.]

	1914	
	Quantity.	Value.
)ikes—	*Kegs.*	
n rolling mills	[1] 1,366,177	$4,201,286
)y manufacturers of bolts, nuts, washers, and rivets		6,011
ls and spikes, other than railroad spikes, made in rolling mills	[2] 45,936	92,783
l		4,300,182

[1] Kegs of 200 pounds. [2] Kegs of 100 pounds.

spikes, made by the manufacturers of bolts, nuts, washers, and rivets—Production in United States.

[From Federal Census.]

dar year) $6,010

Spikes—Imports for consumption—Revenue.

?ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1 cent per pound..	31,892	$738.30	$318.92	$0.023	43.19
.....	.....do.....	3,006	77.00	30.06	.025	39.04
.....	.....do.....	11,425	359.00	114.25	.031	31.82
.....	.....do.[3].....	5,210	105.00	52.10	.020	49.62
.....	⅛ cent per pound [3].	12,725	467.00	95.45	.037	20.44
.....	.....do.....	17,837	353.12	133.77	.019	37.88
.....	.....do.....	19,926	620.00	149.45	.031	24.10
.....	.....do.....	32,763	966.00	245.73	.029	25.44
.....	.....do.[4].....	8,012	272.00	60.09	.034	22.09
.....	Free [5].....	35,716	797.00	.....	.022	.....
.....	.....do.....	45,087	1,077.00	.....	.024	.....
.....	.....do.....	15,000	374.00	.....	.025	.....
.....	.....do.....	25,353	686.00	.....	.027	.....
.....	.....do.....	683,326	19,525.00	.....	.029	.....
.....	.....do.....	145,510	5,419.00	.....	.037	.....

ng keg as 200-pound unit.

ıght iron or steel prior to Oct. 4, 1913.
o Aug. 5, 1909, under act of 1897.
1909, to June 30, 1910, under act of 1909.
o Oct. 3, 1913, under act of 1909.
1913, to June 30, 1914, under act of 1913.

Railroad spikes [1]—Domestic exports.

FISCAL YEARS.

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
Canada	12,496,761	$224,193	7,086,404	$121,999	2,787,835	
Cuba	3,673,055	69,522	3,323,397	55,028	2,966,140	
Mexico	2,812,751	54,540	1,643,286	30,483	1,196,589	
Japan	2,273,925	44,411	1,269,262	26,291	388,716	
Brazil	1,321,711	22,147	704,534	11,603	586,426	
All other	7,456,905	147,387	5,537,735	101,230	4,334,497	
Total	29,975,108	562,200	19,564,618	346,034	12,289,203	

Exported to—	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
Canada	1,482,208	$30,474	2,342,710	$77,492	5,526,631	$
Cuba	7,543,845	160,301	8,252,332	248,115	9,228,879	
Mexico	583,859	16,499	624,931	25,808	682,545	
Japan			606,989	25,583	2,491,306	
Brazil	781,630	19,827	3,848,765	148,156	1,244,232	
All other	[2] 48,754,276	[2] 1,171,413	[2] 27,132,234	[2] 977,276	15,668,547	
Total	59,145,818	1,398,514	42,809,961	1,502,430	34,882,142	1,7

[1] Included in "All other, including tacks," prior to Oct. 4, 1913.

[2] Europe took no exports in 1913 and 1914; in 1915, 893,630 pounds, valued at $11,031; in 1916, 8,3 pounds, valued at $166,680; in 1917, 12,988,146 pounds, valued at $451,174. Russia in Asia took no e until 1916; then 34,472,163 pounds valued at $845,521; in 1917, 7,919,605 pounds, valued at $288,640.

CALENDAR YEARS.

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
Belgium			2,648,320	$1
France	569,160	$46,758	17,963,521	1,11
Russia-Europe			1,590,200	
Canada	5,504,241	228,309	2,260,185	
Mexico	722,784	42,557	1,760,921	
Cuba	6,245,255	311,170	6,733,902	2
Argentina			202,985	
Brazil	1,988,307	145,512	2,563,812	1
Chile	952,242	57,702	1,633,919	
Colombia	108,527	6,076	424,670	
Peru	392,661	22,520	643,665	
China	26,250	2,327	1,575,342	
Dutch East Indies	705,829	66,108	2,137,407	1
Japan	1,964,394	104,950	5,745,618	2
Siam	22,480	1,545	658,528	
Philippines	434,824	28,826	967,773	
British South Africa	97,825	7,035	554,291	
All other	2,597,325	157,694	5,422,172	2
Total	22,330,104	1,229,083	55,487,231	2,8

Railroad spikes—Prices (wholesale or retail) standard railroad spikes, Pittsburgh, per pounds.

[From Metal Statistics, 1918, p. 111.]

1910	$1.61	1915	
1911	1.51	1916	
1912	1.57	1917	
1913	1.72	1918	[1]
1914	1.42	1919	

[1] Adjusted price, Dec. 22, 1917. For iron spikes, $4.50; boat spikes, $5.25 (Nov. 13, 1917).

Weekly and monthly prices are given in the Iron Trade Review; daily in the American Metal M and Daily Iron and Steel Report.

COURT AND TREASURY DECISIONS.

So-called "best steel running spikes," composed of wrought steel in the form of a very thin flat disk nearly one-half inch in diameter, from the center of which on one side a conical point projected about one-fourth inch and used on shoes worn in athletics, were held dutiable as manufactures of metal and not as spikes under the act of 1890. The word "spike," when applied to articles made of iron or steel, was declared to mean a very large nail.—G. A. 2889 (T. D. 15708).

So-called "screw spikes," articles made of metal intended for fastening rails to ties and having neither a slotted head nor point, are not commonly called wood screws, and therefore were held dutiable as manufactures of metal rather than as "screws, commonly called wood screws," under the act of 1897.—G. A. 5823 (T. D. 25711).

Spikes—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	162	Wrought iron or steel spikes, nuts, and washers, and horse, mule, or ox shoes.	2 cents per pound.
1890	176	Spikes, nuts, and washers, and horse, mule, or ox shoes, of wrought iron or steel.	$1\frac{3}{16}$ cents per pound.
1894	148	.....do.....	25 per cent ad valorem.
1897	163	.....do.....	1 cent per pound.
1909	162	.....do.....	$\frac{1}{2}$ cent per pound.
1913	354	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe-nail rods, hobnails and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs.	Free.

HORSESHOE NAILS.

Summary table (fiscal years ending June 30.)

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[1]	Value (imports for consumption.)[2]	Amount of duty.	Value per pound.	Ad equi
		Pounds.					*Per*
1910		13,849		$2,162	$360	$0.156	
1911		14,725		2,250	221	.153	
1912		14,754		1,325	221	.09	
1913		38,365		3,147	575	.082	
1914		183,372		7,725	14	.024	
1915		250,562		12,579		.050	
1916		767,140		43,622		.057	
1917		308,792		17,981		.058	
1918		310,295		39,279		.127	
1919		525,990		37,814		.072	
1920		1,307,040		96,815		.074	

[1] Included under "All other."

[2] Specified as "Horseshoe, hob, and all other wrought-iron and steel nails, not specially provided for." This classification excludes cut nails and spikes, wire nails, spikes, cut tacks, brads, and sprigs.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 554. Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe-nail rods, hob nails, and all other wrought iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs. Free.

DESCRIPTION.

Horseshoe nails, hob nails, and all other wrought iron or steel nails not specially provided for, are included under the same tariff classification. This classification embraces horseshoe nails, which are the product of a distinct industry, the horseshoe-nail manufacturers not making other products, and hob nails, shoe nails, etc., which are produced by the tack mills. The principal product of these mills—cut tacks—are classified separately. A separate classification of horseshoe nails, and the inclusion under one classification of the products of the tack mills—cut tacks, hob nails, and other wrought iron or steel nails not separately provided for—would be an arrangement more in accord with industrial lines.

DOMESTIC PRODUCTION.

Quantity.—The production of horseshoe nails in 1914 is not given by the census, but included under "other" nail products. The figures given for "other" nail products covered establishments of two kinds: Rolling mills and establishments other than rolling mills. For these two classes of establishments the designation "other" nail products did not include exactly the same kinds of nails.

(1) *Establishments other than rolling mills.*—In 1914 the value of "other" nail products manufactured by establishments other than rolling mills was $4,128,189. This figure covered the total value of the products of factories other than rolling mills, whose chief product was nails, other than cut and wire. The products included were horseshoe nails, cut tacks, railroad and other forged spikes (usually made in rolling mills), wire tacks, brads, and staples (not made in wire-drawing establishments), and other nail products.

(a) *Rolling mills.*—In 1914 the value of "other" nail products produced in rolling mills was $62,161. It excluded cut nails, railroad and other forged spikes, wire nails, wire tacks, brads, and staples. The figure, therefore, covered horseshoe nails, cut tacks, cut brads, and other nail products.

The sum of these numbers is $4,190,350. This figure is principally made up of the products of the tack mills (cut tacks, hob nails, shoe nails, and other small cut nails) and horseshoe nails.

In 1904, the only year in which horseshoe nails were specified, the value of the product was $2,345,762. The production of tacks and small nails, shoe tacks, and shoe nails, and miscellaneous nail products was valued at $3,499,634. From these two figures some idea of the relative size of the production of the two principal components of the total for 1914 may be gathered.

Raw material.—Horseshoe nails are made of a grade of iron or steel specially fitted for the bending and cutting to which they are subject in fastening the horseshoe to the hoof. Soft steel and Swedish charcoal iron are used. Previous to 1916 horseshoe-nail rods were imported to some extent from Sweden for this purpose. The total imports for consumption of horseshoe-nail rods in 1915 were 7,312,441 pounds, valued at $129,144. In 1916 and 1917 there was no import.

Process of manufacture.—Hand manufacture of horseshoe nails persisted until a later date than in other branches of the nail industry. In the hand process of manufacture the nail is formed on the anvil with a hammer and cut to the proper length. Then the head is formed by the use of a die.

In the machine process the iron or steel is used in the form of wire about one-half an inch in diameter. This is first drawn through tapering dies and then is pulled through gas-heated cylinders which raise it to a red heat. The wire is next fed to the forging machine, which punches out the nails to correct shape. After they have cooled they are cleaned in tumbling barrels, straightened, and finally sharpened by machinery.

Organization.—The manufacture of horseshoe nails is a distinct industry, the firms engaged in it not producing other articles. In 1918 there were six manufacturers in the United States.

Localities of production.—In 1917 horseshoe-nail factories were located in New York, Connecticut, Pennsylvania, and Illinois. They were thus near the large wholesale markets.

Export.—War conditions have opened the markets in South America, Mexico, Central America, and the West Indies to American nails. Large demands for the product at home, and difficulty of obtaining materials, have resulted in an export unequal to the foreign demand.

IMPORTS.

Quantity.--Prior to 1914 there was a continuous import of shoe, hob, and all other wrought-iron and steel nails not sp provided for" of approximately $3,000 per year. This classif excludes cut nails and spikes; wire nails; spikes; cut tacks, and sprigs; but admits hob and other nails, such as shoe nai 1904, the only year in which the production of horseshoe na been recorded, the import of "horseshoe, hob, and all other wr iron and steel nails not specially provided for" ($3,259), was to 0.13 per cent of the production of horseshoe nails.

Following the removal of the duty under the act of 1913, was an immediate increase in imports. For the three 1910–1912, the average yearly import had been 14,443 poun 1914, 183,372 pounds were imported; in 1915, 250,562, and in 767,140. In 1917 there was a decrease to 306,792 pounds, a 1920 an increase to 1,307,040 pounds.

That horseshoe nails formed an important portion of this i is indicated by a statement of one of the horseshoe-nail com that this product was dumped on the American market (March, to June, 1916).

Source.--Sweden has exported both horseshoe nails and hors nail rods to the United States.

Revenue.--Under the act of 1897, from July 1, 1906, to Aug 1909, imports were valued at $5,451.50, on which a duty of $ was collected, at a specific rate equivalent to 16.30 per ce valorem. Under the act of 1909 (Aug. 6, 1909, to Oct. 3, 1 imports were valued at $8,167, on which a revenue of $1,135.4 collected, at a specific rate equal to 13.90 per cent ad valorem. the first rate revenue averaged approximately $285 per year, und second (a slightly lower rate) approximately $272.

TARIFF HISTORY.

Paragraph 554 of the act of 1913 placed "horseshoe nails, shoe-nail rods, hob nails, and all other wrought-iron or steel not specially provided for" on the free list.

The act of 1890 first specified horseshoe and hob nails, pl with them all iron or steel nails not specially provided for, and them dutiable at 4 cents per pound. The next act (1894) ch this to 30 per cent ad valorem. The act of 1897 restored the sp duty at 2½ cents per pound, and the act of 1909 reduced it cents per pound.

COMPETITIVE CONDITIONS.

During the war there was a very large demand for hors nails, both for the Army and home consumption here and for ment abroad. Under war conditions, markets in Mexico, the Indies, and South and Central America, formerly to a large exte foreign hands, were opened to the American product. Pri the war one great difficulty to be met here was that the in business in these countries was largely in German hands.

The American manufacturers were able to satisfy only a part of this demand, because of the needs of our Army

allied Governments, and the shortage of raw material. Enough sent, however, so that the importers are familiar with the erican product and it is felt that there are large opportunities the American manufacturer in these markets.

he raw material for horseshoe nails is either Swedish iron or soft l. The former is imported to some extent, and is used for high lity nails.

he import of foreign nails has increased since they were put upon free list, but still it does not represent a large amount in relation the total production. In 1916 the imports seem to have been normal, and a manufacturer has called attention to this import a case of the dumping of a foreign product on the American rket.

After the war the American manufacturers may expect severe ign competition in the new export markets which they have ad. In this country the manufacture of horseshoe nails is an dependent industry, and manufacturers feel that this may prove disadvantage if their competitors are large firms manufacturing rseshoe nails only as a by-product. This is generally not the case, one German firm is known to operate in this manner.

TARIFF QUESTIONS.

The last appearance of the horseshoe-nail manufacturers before Ways and Means Committee was in 1893. No protest was made 1913 against placing horseshoe nails on the free list.

Horse nails—Production in United States (calendar year).

[From Federal Census.]

	Value.
	$2,345,762

other [1] *nails and spikes (including tacks), made in rolling mills—Production in United States (calendar years).*

[From Federal Census.]

Year.	Quantity.	Value.
	Kegs of 100 pounds.	
	(2)	(2)
	(2)	(2)
	29,916	$62,161

[1] Other than cut nails and spikes, forged nails and spikes, wire nails and wire tacks, brads and staples.
[2] Figures not available.

other [1] *nails and spikes (including tacks) not made in rolling mills—Production in United States (calendar years).*

[From Federal Census.]

	Value.
	(2)
	(2)
	[3] $4,128,189

[1] Other than cut and wire nails and spikes.
[2] Figures not available.
[3] Value of all products of establishments whose chief product is all other nails and spikes, including tacks.

Horseshoe, hob, and all other wrought-iron or steel nails, n. s. p. f.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ad val. equiv.
		Pounds.				
1907	2½ cents per pound.	946	$83	$21	$0.088	
1908	do	15,572	1,917	350	.123	
1909	do	16,056	2,647	361	.165	
1910	do	6,922	803	155	.116	
1910	1½ cents per pound.	6,927	1,358	103	.196	
1911	do	14,725	2,249	220	.153	
1912	do	14,754	1,325	221	.089	
1913	do	38,365	5,147	575	.082	
1914	do	920	87	13	.095	
1914	Free	182,452	7,638		.042	
1915	do	250,502	12,579		.050	
1916	do	767,140	43,622		.057	
1917	do	306,792	17,931		.058	
1918	do	310,295	39,279		.127	
1919	do	525,990	37,814		.072	
1920	do	1,307,040	96,813		.074	

Nails and spikes, all other,[1] including tacks—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	648,247	$39,875	512,999	$31,972	671,077	
Canada	656,547	20,021	1,691,802	56,163	6,226,126	
Mexico	3,801,986	114,837	9,160,102	193,883	4,103,018	
Cuba	4,324,014	110,690	3,479,303	94,480	5,052,586	
Argentina	657,367	32,786	413,610	18,200	696,453	
Brazil	691,301	25,290	1,247,131	34,361	1,510,346	
Japan	713,147	28,154	3,537,374	78,224	2,929,150	
Australia	[2] 742,534	[2] 39,849	620,001	31,523	1,045,340	
All other	6,503,027	201,502	6,545,665	198,317	5,927,039	
Total	18,738,170	613,004	27,207,987	737,131	28,161,235	

[1] Other than wire and cut nails and spikes and railroad spikes, 1913 and later.
[2] Australia and Tasmania.

Nails and spikes, all other,[1] including tacks—Domestic exports (fiscal years)

Exported to—	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	917,834	$56,250	339,580	$22,227	2,025,988	
Canada	1,256,089	48,063	796,494	34,164	427,006	
Mexico	1,328,990	57,555	411,420	18,514	787,415	
Cuba	648,697	35,684	613,942	35,846	728,957	
Argentina	710,339	32,668	630,776	36,123	906,626	
Brazil	627,819	28,744	545,461	25,294	516,021	
Japan	306,589	15,950	239,355	14,284	343,484	
Australia	873,508	45,690	815,599	43,764	746,389	
All other	2,759,163	126,521	2,739,928	138,214	5,737,602	
Total	9,429,118	447,125	7,132,555	368,430	12,219,488	

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	5,229,287	$260,664	4,038,492	$345,058	2,787,487	
Canada	494,756	19,724	1,713,058	84,245	1,095,062	
Mexico	808,381	53,966	1,223,099	103,210	1,234,264	
Cuba	1,334,824	59,898	4,828,209	223,595	1,929,746	
Argentina	1,761,781	135,453	1,954,599	166,241	1,749,207	
Brazil	1,071,749	73,006	1,387,489	131,565	1,168,211	
Japan	475,716	32,293	563,777	56,017	750,988	
Australia	1,009,366	55,121	1,308,704	106,222	2,012,946	
All other	9,394,162	458,550	26,761,485	2,034,102	16,604,771	
Total	21,580,022	1,148,675	43,778,912	3,150,255	29,332,682	

[1] Other than wire and cut nails and spikes, and railroad spikes, 1913 and later.

and spikes, all other,[1] *including tacks—Domestic exports (calendar years).*

Exported to—	1918		1919	
	Pounds.		*Pounds.*	
	1,934,314	$332,411	4,671,721	$594,129
	587,610	94,308	1,363,949	211,431
	982,636	125,121	892,460	121,638
	1,148,032	224,394	224,939	42,553
	586,865	40,930	997,846	163,029
	1,116,742	100,145	988,934	92,957
	1,043,946	120,124	1,414,954	192,823
	1,789,224	209,645	2,343,496	230,014
	2,156,347	391,576	3,170,270	442,807
	1,377,167	223,938	2,537,414	432,821
	1,472,431	143,088	891,189	124,875
	327,364	56,122	1,026,348	155,398
	461,604	54,515	928,079	100,404
	1,122,314	84,499	1,161,688	98,160
	1,677,475	172,300	882,560	116,206
	1,310,510	136,192	1,106,515	127,690
	2,091,168	287,398	2,134,863	319,931
	404,146	39,434	1,601,737	160,751
h Africa	379,097	51,550	1,286,603	139,758
	4,345,293	462,880	6,738,963	770,718
	26,414,285	3,336,570	36,364,528	4,638,093

[1] Iron wire and cut nails and spikes, and railroad spikes, 1913 and later.

COURT AND TREASURY DECISIONS.

horseshoe nails, known as "frost nails," constructed with aped heads which serve the purpose of calks and prevent om slipping on icy surfaces, are exempt from duty as horse- ls of iron or steel under paragraph 554 of the act of 1913, cludes all horseshoe nails so composed, whether of the ordi- improved or patented varieties, so long as they retain their as and are commonly and commercially known and recog- horseshoe nails. (G. A. 8210; T. D. 37818 of 1918.)

Horseshoe nails—Rates of duty.

	Tariff classification or description.	Rates of duty, specific and ad valorem.
..	Not specified	
4	Horseshoe nails, hobnails, and all other wrought iron or steel nails not specially provided for in this act.	4 cents per pound.
6	.....do	30 per cent ad valorem
1	.....do	2½ cents per pound.
0	Horseshoe nails, hobnails, and all other wrought iron or steel nails not specially provided for in this section.	1½ cents per pound.
4	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe nail rods, hobnails, and all other wrought-iron or steel nails not specially provided for in this section; wire staples, wire nails made of wrought iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs.	Free.

TACKS, BRADS, AND STAPLES.

SUMMARY.

Paragraph 554 of the act of 1913 covers iron and steel cut nails and spikes, horseshoe nails, horseshoe-nail rods, hobnails, and all other wrought-iron or steel nails not specially provided for; wire staples, wire nails of wrought iron or steel, spikes, cut tacks, brads, and sprigs, and horse, mule, and ox shoes.

The tacks, brads, and staples covered in this catalogue are made almost entirely by automatic machinery. The annual production (1918) of the cut tack industry was estimated at from 50,000,000 to 60,000,000 pounds, valued at $6,600,000. The domestic production apparently satisfies the domestic requirements. Considerable quantities are exported, principally to Argentina, Australia, the Orient, South Africa, Mexico, and Cuba.

Germany, England, France, and Belgium were the principal producers prior to 1914. Recently (1919) considerable quantities have been manufactured in Japan and Canada. The imports from Canada enter the domestic market at Detroit, Buffalo, and Toledo, and are used largely in the manufacture of automobiles.

The American Tack Manufacturers' Association states that the prices of tacks have increased more than 90 per cent since 1910. It furnishes a comparison between domestic and foreign prices and costs by quoting the prices of certain grades of tacks of a large American company on certain foreign markets, 1914–1915, and foreign prices at the same time on the same markets; also the selling price of an English company in 1913, on one grade of tacks, in comparison to that of the American company just mentioned. The costs of the American company are likewise given. On this representation, the price of the foreign-made article is less than both the American price and cost.

Cut tacks, brads, and sprigs were admitted free under the act of 1913. Under prior acts, except that of 1894, there was a specific duty ranging from ¾ to 3 cents per pound.

Tacks, brads, and staples—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Ratio to production.		Value (imports for consumption).[2]	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
			Imports.	Exports.				
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*				*Per cent.*
1910	.....	517	.....	.....	$22.00	$3.23	.....	14.6
1911	.....	22	.....	.....	5.00	.16	.....	3.2
1912	.....	22	.....	.....	6.00	.14	.....	2.3
1913	.....	3,842	.....	.....	135.36	24.02	.....	17.7
1914	66,670,000	436,256	.03	.....	2,242.00	.....	$0.002	.....
1915	.....	86,355	.....	.....	4,842.00	.....	.056	.....
1916	.....	226,614	.....	.....	9,578.00	.....	.042	.....
1917	.....	105,770	.....	.....	8,011.00	.....	.076	.....
1918	.....	97,559	.....	.....	14,590.00	.....	.150	.....
1919	.....	137,554	.....	.....	17,648.00	.....	.128	.....

[1] Calendar years.
[2] Fiscal years ending June 30.
[3] Wire tacks, brads, and staples.
[4] Included under "all other nails and spikes."
[5] Import wire staples to production wire tacks, brads, and staples.

General Information.[1]

TARIFF PARAGRAPH, ACT OF 1913.

P. 554. * * * Wire staples, wire nails made of wrought iron steel. * * * and cut tacks, brads, or sprigs, free.

DESCRIPTION.

Kinds.—There are two kinds of tacks and brads—cut and wire. e manufacturers of cut tacks usually confine themselves to cut ks, brads, small cut nails and shoe nails, although they manu- ture to some extent wire tacks also. These products have been ssified under two price lists issued by the American Tack Manu- turers' Association. The first of these lists—the hardware list— vers bill posters' tacks, American carpet tacks, upholsterers' tacks, nerican cut tacks, gimp tacks, lace tacks, Swede's cut tacks, and mmers' tacks, basket tacks, solid head lining nails, and tacks signed for many other purposes. It also includes clout, trunk, sket, chair, and finishing nails. The second list, the shoe finders' t, covers cobblers' nails, clinching nails, pegging shoe nails, shank cks and nails, and hand shoe tacks.

Wire tacks, brads, and staples are produced to a large extent by e wire industry, although some are made in conjunction with cut cks. The demand for wire tacks, as a substitute for cut, has been timated at about 6,000,000 pounds per year in normal times.

Tariff classification.—Cut tacks, brads, and sprigs have been ecified in the tariff acts since 1883. The first of these designations vers the ordinary carpet tack and other tacks, manufactured from eets of steel. The second applies to a short cut nail of small cross ction and small head. Sprig is an obsolete word in the trade; rmerly it was applied to sharp pointed shoe heel nails.

Wire staples were first specified by the act of 1913.

The present classification, under which cut tacks, brads, and sprigs e classified separately, and hob nails and nails not otherwise speci- d are included with horseshoe nails, does not follow industrial lines. he horseshoe nail is the product of a distinct industry, which does t manufacture other nail products. (See Survey on Horseshoe ils.) On the other hand, hobnails and many of the nails falling der the not otherwise specified clause, as shoe nails, are the product the tack mills. An arrangement more in accord with industrial es would be a separate classification of horseshoe nails, and the clusion of nails not otherwise specified with cut tacks, brads, and rigs. The last word, now obsolete in the trade, could then be opped, for these nails—sharp pointed shoe heel nails—would be cluded under the "not otherwise provided for" clause, and thus l with cut tacks, as before. In order to prevent any nail products ade of wire, which are to only a small extent produced in the tack lls, being classified with the products of these mills, wire tacks and ads might be classified separately, or added to another nail classifi- tion, as wire staples.

[1] Report of the American Tack Manufacturers' Association, Nov. 21, 1918. Much of the material ered under "General Information" will be found in this report.

Uses.—Approximately one-half of the production of tacks and small nails is used in the manufacture and repair of shoes; the next largest use is probably for upholstering and trimming. In addition to these two industries, tacks are sold directly to railroads, tanneries, ship and boat builders, basket makers, and manufacturers of trunks, coffins, saddlery, furniture, roofing, brooms, blinds, whips, wire screens, and other articles. Thus to a large extent tacks are not bought by the "ultimate" consumer, but enter into manufacturing processes resulting in the product which he buys. Changes in retail price thus affect him less widely, if more directly, than changes in wholesale prices, which affect him as changes in one item among the raw materials making up some given product which he uses.

DOMESTIC PRODUCTION.

Quantity.—The production of cut tacks and brads in 1914 is not given by the census, but included under "other" nail products. The figures given for "other" nail products covered establishments of two kinds; rolling mills and establishments other than rolling mills. For these two classes of establishments the designation "other" nail products did not include exactly the same kinds of nails.

The production of wire tacks, brads, and staples in 1914 was recorded only for establishments drawing wire, whether rolling mills or other wire-drawing establishments.

(1) *Establishments other than rolling mills.*—In 1914 the value of "other" nail products manufactured by establishments other than rolling mills was $4,128,189. This figure covered the total value of the products of factories other than rolling mills, whose chief product was nails, other than cut and wire. The products included were horseshoe nails, railroad and other forged spikes (usually made in rolling mills), wire tacks, brads, and staples (not made in wire-drawing establishments), and other nail products.

(2) *Rolling mills.*—In 1914 the value of "other" nail products produced in rolling mills was $62,161. It excluded cut nails, railroad and other forged spikes, wire nails, wire tacks, brads, and staples. The figure therefore covered horseshoe nails, cut tacks, cut brads, and other nail products.

(3) *Establishments drawing wire.*—In 1914 the value of wire tacks, brads, and staples produced in wire-drawing establishments (including both rolling mills and other establishments drawing wire) was $1,324,948.

The sum of the first two numbers (1+2) is $4,190,350. This figure is principally made up of the products of the tack mills (cut tacks, hobnails, shoe nails, and other small cut nails) and horseshoe nails. The total, obtained by adding the third figure to this sum (1+2+3) is $5,515,298. In 1904, the only year in which tacks and small nails, shoe tacks, and shoe nails, and miscellaneous nail products were specified, the value of these products was $3,499,634. The production of horseshoe nails in this year was $2,345,762. (See Survey on Horseshoe Nails.) From these two figures some idea of the relative size of the production of the two principal components of the total for 1914 may be gathered.

In 1918 a committee of the American Tack Manufacturers' Association estimated the yearly output of cut tacks and small nails at

,000,000 to 60,000,000 pounds, at that year's prices having a value about $6,600,000.

Material and equipment.—Cut tacks and small nails are made from eets of open-hearth steel, copper, brass, or zinc.

The sheets ordinarily used in tack making vary, according to the e of the tack, from 21 to 11 wire gauge in thickness (0.02846 to 09074 inch). Common tacks are made as follows:

Size.	Length.	Thickness of stock.	Size.	Length.	Thickness of stock.
	Inch.	*Inch.*		*Inch.*	*Inch.*
ance	⅜	0.032	12-ounce	⅝	0.065
ounce	⅜	.035	14-ounce	⅝	.065
ance	½	.042	16-ounce	¾	.072
ance	½	.042	18-ounce	¾	.072
ance	½	.049	20-ounce	⅞	.083
ance	½	.049	22-ounce	1	.083
ounce	½	.058	24-ounce	1⅛	.083

Wire tacks are made from coiled wire, of open-hearth steel, copper, nd brass, of the gauge required for the tack to be produced. The aterial used is domestic.

The machines used in the manufacture of cut tacks, both in the nited States and abroad, contain the same elements as the original atent in this country. Those used in the manufacture of wire acks are similar here and abroad.

Process of manufacture.—The sheets of steel from which the tacks e made come from the sheet mills in bundles. They are separated om each other by metal clips and immersed in a pickling bath of ilute sulphuric acid in which they remain about 20 minutes. They e then washed in a tank provided with circulating water, which nses off the sulphuric acid, and finally in a bath of lime water.

After the sheets have been inspected for thickness and carefully orted to secure uniformity, they are cut by a slitting machine into trips of the width necessary for the proper length of shank and the psetting of the head. These strips are again inspected and sorted y means of limit gauges. They then go to the tack machines. he strip is grasped by tongs at one end and fed to the machine hrough a tube, arranged so as to turn the strip over between each ut of the machine. The cutting knives are set at an angle to the trip, and as the strip is constantly fed in and turned over, they cut sharp pointed triangular piece from it, the base of the triangle being ormed by the edge of the strip and the sides by the oblique end left y the preceding cut and the side formed by the machine in cutting ff the blank.

The cutting is done by two knives, working in unison, one of which a little ahead of the other. This knife cuts through the sheet; he second descends, completing the shear, and carrying the blank own to the gripping dies below the knives. These seize the blank, aving some of the large end projecting. This is hit by the heading e advancing from the side of the machine; the dies relax, and the mpleted tack drops into the hopper below. The strip above has w been turned, and the knives advance for a second cut. The achines run at a rate of from 200 to 325 tacks per minute.

A portion of the tacks so made are tumbled in barrels with graphite, which removes the sharp edges and gives them a pleasing polish. They are then machine sorted to eliminate imperfect heads.

The tacks may be sold as they are, or finished by bluing, tinning, or coppering.

Heel nails, which have no head, are cut on a different kind of machine. It consists simply of a shear, into which four strips are fed. Instead of the stock being turned over to get the diagonal cut necessary, the cutting head of the machine is oscillated. It makes 300 cuts (2,000 heel nails) per minute.

Wire tacks, brads, and staples are made from wire by cutting and stamping processes. It is first passed through straighteners, and then to a machine which points, cuts off, and heads (or bends) the wire. These machines make from 300 to 500 tacks per minute.

Labor.—In this country the workers are practically all males. Girls are used in some factories to feed strips to the machines, and employed in all concerns to pack the tacks in small paper cartons when these are used, before the tacks are packed in wooden boxes for shipment.

Markets.—The principal markets are in the hardware jobbing centers—the principal cities of the country—and sales are proportional to the size of the city. Tacks are also sold direct to many manufacturers.

Organization and capitalization.—Cut tacks and brads are made by the cut-tack industry, the product of which is cut tacks and small nails cut from sheets. Some tack firms make wire tacks and brads also. The cut-tack industry comprises many firms; the principal manufacturers number approximately 30. In 1913 the capital devoted to cut-tack production was estimated at $3,000,000, the firms varying in size from $5,000 to $300,000.

Wire tacks, brads, and staples are made by the wire industry—firms drawing wire—an industry of large establishments. (See Survey on Round Iron and Steel Wire, Plain and Galvanized.) Some establishments purchasing wire also make tacks, brads, and staples.

Localities of production.—Massachusetts produces more tacks than any other State. There are important firms in New Hampshire and Connecticut among the New England States; in New York, Maryland, and Pennsylvania; in Ohio, Indiana, Illinois, and Wisconsin among the Middle Western States.

The early start of the industry in New England is among the reasons for the predominance of that part of the country in the manufacture of tacks. The presence of a large labor supply is doubtless also a factor. The market for tacks—varying with the size of the cities—helps to explain both the large production of New England and the growth of factories in the Middle West.

Domestic consumption.—The existing statistics are not sufficiently detailed to make a numerical estimate of consumption possible. The material at hand indicates a production in excess of domestic consumption.

Exports.—Prior to the war American tacks and small nails were exported to South America, principally Argentina; to Central America, Australia, the Orient, South Africa, Mexico, and Cuba, in order of importance. Much of this export consisted of shoe nails. In 1913 the amount exported was estimated as 10 per cent of the production.

The exports of tacks are included under the classification "All, er nails and spikes."

History.—The first automatic tack machine was invented by omas Blanchard, of Abington, Mass., in 1827. The present ma- nes, both the foreign and the domestic, embody the principle of Blanchard machine.

The growth of the American industry began after 1824. The raw terial used by the early manufacturers was almost entirely Swedish n, though some American iron was used for the cheaper qualities. 1882 German basic open-hearth bars were rolled at Bridgewater, d the tack plate was sent to the manufacturers for trial. The ult was the general use of this German steel, together with Swedish n, until about 1896, when American steel became low enough in ce to be substituted. American soft steel sheets, rolled in Penn- lvania, were used to some extent for shoe tacks after 1888, because eir accuracy of gauge was greater than that of the tack plate rolled that time.

The introduction of American shoe machinery made the foreign arket for American tacks. These machines required tacks and nails great accuracy in size and shape, which was possessed by the nerican product. Exports went to England and continental rope, where they came into competition with German products, ade on American machines. There were even some imports into e United States under the 25 per cent duty of the act of 1894.[1] ith the use of open-hearth sheets, which began in 1896, and enabled e United States manufacturers to make tacks of lighter gauges and re desirable shapes, there was a recovery of export trade.

FOREIGN PRODUCTION.

Principal producing countries.—Previous to 1915 the principal eign producers were Germany, England, France, and Belgium. panese competition was then beginning to be felt in the Orient and uth America, and has increased. Canadian tacks have appeared the American market.

IMPORTS.

Quantity.—From 1907 to 1913 imports of cut tacks, brads, and igs were sporadic. They were recorded in thousands and in unds, according to size, so that total quantities can not be given these years. The average yearly value of the imports was $60.34. om 1914 to 1917 the average import was 81,000 pounds, valued at 100. When the act of 1913 placed them on the free list, there was immediate increase in import. In 1914 18,246 pounds were im- ted, valued at $1,114; in 1915, 82,455 pounds, valued at $4,735; 1916, 117,925 pounds, valued at $6,604; in 1917, 104,770 pounds, ued at $7,974; and in 1920, 202,741 pounds, valued at $25,991.

A similar increase took place in the imports of "horseshoe nails, nails, and all other wrought iron or steel nails not specially pro- ed for," a classification which covers some of the products of the k mills. The yearly average import of such nails, 1907–1913, was 300 pounds, valued at $1,930; for 1914–1917, 377,000 pounds, ued at $20,500. (See Survey on Horseshoe Nails.)

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[1] 8,000 pounds, valued at $12,300, in 1896, the year showing highest imports under that act. Imports 16 were 118,000 pounds, valued at $6,600.

The imports of staples, recorded only after October 3, 1913, varies greatly. The average yearly import, 1914–1917, was approximately 33,000 pounds, valued at $1,060.

Source.—Imports were of some size only in 1895 and 1896, and since 1913. In the first period they came from Germany; since the beginning of the war they have been from Canada.

Destination.—The Canadian tacks have been imported into a limited area, including western New York, eastern Ohio, and southern Michigan. The manufacturers of automobiles have used a large portion of these tacks.

Revenue.—The total revenue derived from the duty on cut tacks, brads, and sprigs, under the act of 1909 (Aug. 6, 1909 to Oct. 3, 1913) was only $27.82 on an import of $170.36, the duty thus being equivalent to 16.33 per cent ad valorem. Except in 1895 and 1896 when the revenue was $2,143 and $3,075, respectively, under a 25 per cent ad valorem duty, it did not amount to over $150 any one year after 1894.

PRICES.

The American Tack Manufacturers' Association has submitted the following statements relative to domestic prices:

In 1913 the prices of tacks in this country were 33⅓ per cent below those of 1910. About the middle of 1914 the association, in an attempt to stablilze prices, adopted the "open price" policy, under which the prices of the individual establishments were made known to all its members. Demand following the outbreak of the war, resulting from the fact that France, Germany, and Belgium were unable to supply their former markets, combined with increasing costs of production, led to an increase of average price in 1918 to approximately 90½ per cent over that of 1910.

Export prices have been the same as domestic since 1915; previously they were lower.

Normally, wire tacks have sold for slightly more than the corresponding grade of cut tacks; since the outbreak of the war, however, war demands have so affected the two raw materials—sheets and wire—as to result in the wire tack becoming the cheaper.

The Atlas Tack Co., one of the largest manufacturers and a member of the association, has submitted its own and foreign prices of certain specific kinds of tacks on various foreign markets, 1914–15, and a comparison of its prices on a certain grade of tacks with those of a British firm in 1913. In these instances the foreign prices are lower than the American; as compared with the British company, the differences on the specific grade quoted were from 16 to 35 per cent.

These figures have not been verified. Further information, especially on foreign prices, is being collected by the commission.

TARIFF HISTORY.

United States.—Paragraph 554 of the act of 1913 admits cut tacks, brads, or sprigs free; also wire staples, which had not been specified in preceding acts.

Prior to the act of 1913 cut tacks, brads, or sprigs bore a specific duty (except under the act of 1894), varying according as they did or did not exceed 16 ounces to the thousand. The act of 1883 laid on

se not exceeding 16 ounces per thousand a duty of 2½ cents per usand, and on those exceeding this, 3 cents per pound. The of 1890 reduced these rates to 2¼ cents per thousand and 2¾ cents pound. The act of 1894 changed these specific rates to an valorem rate of 25 per cent. In 1897 a specific duty was restored, 1¼ cents per thousand on those cut tacks, brads, and sprigs not eeding 16 ounces to the thousand, and 1½ cents per pound on those eeding this. The act of 1909 reduced these rates to ⅛ cents per usand and ¼ cents per pound.

Hob and some other small nails made in the tack-making establishnts would fall under Horseshoe, hob, and all other wrought iron d steel nails not specially provided for.[1]

COMPETITIVE CONDITIONS.

Domestic market.—The cut tack industry is one of numerous small ns. The competition between them from 1911 to 1914 is called Destructive" in the report of the American Tack Manufacturers' sociation (1918). In the middle of 1914 the association adopted "open price" policy; i. e., that the prices made by any member the association be made known to the others.

During only two periods have foreign cut tacks and small nails been d in the United States in appreciable quantities—in 1895 and 1896, d since 1914. During the first period imported material was to ne extent used for the manufacture of tacks. The act of 1894 d a duty of 35 per cent on the raw material and 25 per cent on the ished product, an arrangement protested against by the manuturers. At this time the German firms sent an agent to the ited States to reach an agreement with American firms. No eement was reached, however, and severe competition followed, th in the foreign market and in the United States. Here it was y brief, importations being of some size only for the two years ntioned. The use by the American manufacturers of openarth steel sheets, which enabled tacks of a smaller gauge to be de, began at this time. Recovery of the domestic market followed l later the act of 1897 placed a specific duty on these products in ce of the relatively low ad valorem rate of the preceding act.

Since the passage of the act of 1913 imports have grown approxitely the size they attained in 1896. European competition, pected as a result of tacks being placed on the free list, did not velop at once, possibly because of the competition of domestic nufacturers with each other, and the breaking out of the war vented it later. The tacks actually imported have been Canadian. ey have entered the domestic market at a time of expanding ign trade, while earlier competition came when foreign trade was ng subjected to severe competition.

Export market.—The original export market for the American nufacturer of tacks and small nails was created by the sale of erican shoe machinery. This machinery demanded nails of uracy and uniformity in shape and size, qualities in which the duct of the American tack machines excelled. Similar machines ne to be used by the Germans, with whom the American manuturers came into competition on the European market. Severe

[1] Survey on Horseshoe Nails.

competition resulted, as has been stated, particularly in 1895 and 1896.

The exported American shoe nails and tacks have now the advantage of accuracy and uniformity of shape. The American common tack has a similar advantage, but in this case it is of less importance than for the shoe nail, since common tacks are not for use in machinery making a demand for accuracy.

War conditions have meant that France, Belgium, and Germany could not supply their former markets, and demand has sprung up for the American product. Lack of raw material and transportation facilities have made it impossible for the American industry to completely supply these markets, but these difficulties are expected to disappear.

Export markets in the future, after the rehabilitation of European industry, will be subject to European competition, as before the war. The American Tack Manufacturers' Association expresses doubt of the ability of the American manufacturers to hold the new markets under the disadvantage of the lower European wage rates.

Japanese competition on foreign markets has begun to make itself felt since the outbreak of the war and will be maintained in addition to the former competition.

Costs.—One domestic manufacturer voluntarily submitted a statement for the cost at which it manufactures the grades given. These costs are above the foreign selling prices.

TARIFF QUESTIONS.

Between September 29 and October 8, 1918, a circular letter was sent by the United States Tariff Commission to a number of the tack manufacturers and the horseshoe-nail manufacturers. It embodied the suggestion "that 'horseshoe nails' be classified by themselves, while 'hobnails and all other wrought-iron or steel nails not specially provided for' be included with 'cut tacks, brads, or sprigs.' One classification would thus be 'horseshoe nails,' the other 'cut tacks, brads, or sprigs, hobnails, and other wrought-iron or steel nails not specially provided for.'" Of the 17 answers received, 3 did not discuss the suggestion, while the remaining 14 were favorable to it. The arrangement of this clause makes it possible to drop the "sprig," now obsolete in the trade, for the articles so named would fall under the "not specially provided for" clause.

The American Tack Manufacturers' Association submitted a brief under date of November 21, 1918, following an outline of information desired which was sent to it by the commission. This report is a part of the auxiliary file.

The opinion of the manufacturers' association is that protection of at least 25 per cent ad valorem should be extended to tacks and small nails, and against Canada a duty equal to her duty. The arguments advanced in support of this view were: That there is a tariff on sheets, the raw material of tacks and small nails; that, though tacks have been put on the free list, no reduction has been made in price to the consumer who bought at retail, 1910-1914; that Canada levied a duty, while the United States admitted her goods free; and the fact that there was a duty on other small iron and steel articles, as bolts, rivets, and wood screws.

Production in the United States.

[From Federal Census.]

	1904	1909		1914	
	Value.	Quantity.	Value.	Quantity.	Value.
Wire brads, tacks, and staples, made in rolling mills and wire-drawing mills		*Tons.* 28,125	$1,324,170	*Tons.* 33,335	$1,324,948
Tacks and small nails, not made in rolling mills or steel works	$1,664,161				
Shoe tacks and shoe nails, not made in rolling mills or steel works	988,144				
All other nails and spikes including tacks (other than wire nails and tacks), made in rolling mills					62,161
All other nails and spikes (other than cut and wire nails and spikes) including tacks, not made in rolling mills					4,128,129

Cut tacks, brads, or sprigs—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
	Not exceeding 16 ounces to the thousand — Acts of 1897 and 1909.	*Pounds.*				*Per cent.*
1907	1½ cents per pound	1,596	$140.00	$20.00	$0.088	14.26
1908	....do....					
1909	1¼ cents per thousand.	979	50.00	12.00	.051	24.50
		167	28.00	2.00	.168	7.50
1910	¾ cent per thousand	517	22.00	3.00	.043	14.68
1911	....do....	12	2.00		.167	
1912	....do....	22	6.00		.273	
1913	....do....	3,840	135.00	24.00	.035	17.77
	Exceeding 16 ounces to the thousand—Acts of 1897 and 1909.					
1907	1½ cents per pound	4	2.00	.06	.500	3.00
1908	....do....	433	34.00	6.00	.079	19.09
1909						
1910						
1911	¾ cent per pound	10	3.00		.300	
1912						
1913	¾ cent per pound	2				
1914	....do....	36	2.00		.056	
1914	Free	18,210	1,112.00		.061	
1915	....do....	82,455	4,735.00		.057	
1916	....do....	117,925	6,604.00		.056	
1917	....do....	104,770	7,974.00		.076	
1918	....do....	97,049	14,512.00		.149	
1919	....do....	136,674	17,564.00		.128	
1920	....do....	202,741	25,991.00		.128	

Wire staples—Imports for consumption—Revenue.

Fiscal year:	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914 [1]	Free	18,010	$1,128		$0.063	
1915	do	3,900	107		.027	
1916	do	108,689	2,974		.027	
1917	do	1,000	37		.037	
1918	do	510	78		.153	
1919	do	880	84		.095	
1920	do	123,110	7,581		.062	

[1] Not separately shown prior to 1914.

Nails and spikes, all other,[1] including tacks—Domestic exports (fiscal years).

Exported to—	1910		1911		1912	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	648,247	$39,875	514,999	$31,972	671,077	$43,531
Canada	656,547	20,021	1,691,802	56,163	6,226,126	176,371
Mexico	3,801,986	114,837	9,160,102	193,885	4,103,018	103,258
Cuba	4,324,014	110,690	3,479,303	94,480	5,052,686	115,267
Argentina	657,367	32,786	413,610	18,206	696,453	26,430
Brazil	691,301	25,290	1,247,131	34,361	1,510,346	42,207
Japan	713,147	28,154	3,537,374	78,224	2,929,150	65,721
Australia	[2] 742,534	[2] 39,849	620,001	31,523	1,045,340	50,619
All other	6,503,027	201,502	6,545,665	198,317	5,927,039	188,048
Total	18,738,170	613,004	27,207,987	737,131	28,161,235	811,731

	1913		1914		1915	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	917,834	$56,250	339,580	$22,227	2,025,988	$117,494
Canada	1,250,089	48,063	796,494	34,164	427,006	19,635
Mexico	1,328,990	57,555	411,420	18,514	787,415	30,459
Cuba	648,697	35,684	613,942	37,846	728,957	44,725
Argentina	710,339	32,668	630,776	36,123	906,626	53,321
Brazil	627,819	28,744	545,461	25,294	516,021	26,854
Japan	306,589	15,950	239,355	14,284	343,484	19,398
Australia	873,598	45,690	815,599	43,764	746,389	41,433
All other	2,759,163	126,521	2,739,928	138,214	5,737,602	321,980
Total	9,429,118	447,125	7,132,555	368,430	12,219,488	675,299

	1916		1917		1918	
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	5,229,287	$260,664	4,038,492	$245,058	2,787,487	$179,22
Canada	494,756	19,724	1,713,058	84,245	1,095,062	83,778
Mexico	808,381	53,966	1,223,099	103,210	1,234,264	143,15 5
Cuba	1,344,824	59,898	4,828,209	223,595	1,929,746	211,619
Argentina	1,761,781	135,153	1,954,599	166,241	1,749,207	255,473
Brazil	1,071,749	73,006	1,387,489	131,365	1,168,211	140,094
Japan	475,716	32,283	763,777	56,017	750,988	85,014
Australia	1,009,366	55,121	1,308,704	106,222	2,012,946	251,194
All other	9,794,162	458,750	26,761,185	2,034,102	16,604,771	1,924,970
Total	21,580,022	1,148,675	43,778,912	3,150,255	29,332,682	3,314,643

[1] Other than wire and cut nails and spikes, and railroad spikes, 1913 and later.
[2] Australia and Tasmania.

Nails and spikes, all (including tacks)—Domestic exports (calendar years).

Exported to—	1918		1919	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
.....	1,934,314	$332,411	4,671,721	$594,129
.....	587,610	94,308	1,363,949	211,431
.....	982,636	125,121	892,460	121,638
Kingdom.....	586,865	40,930	1,039,253	166,008
.....	1,116,742	100,145	988,934	92,957
.....	1,043,946	120,124	1,414,954	192,823
.....	1,789,224	209,645	2,343,496	230,014
na.....	2,156,347	391,576	3,170,270	442,807
.....	1,377,167	223,938	2,537,414	432,821
.....	1,472,431	143,088	891,189	124,875
ia.....	327,364	56,122	1,026,348	155,398
y.....	461,604	54,515	928,079	100,404
.....	1,122,314	84,499	1,161,688	98,160
India.....	1,677,475	172,300	882,560	116,206
ia.....	1,310,510	136,192	1,106,515	127,690
aland.....	2,091,168	287,398	2,134,863	319,931
ines.....	593,276	74,845	655,320	93,959
South Africa.....	404,146	39,434	1,601,737	160,751
ar.....	379,097	51,550	1,286,603	139,758
	5,000,049	508,429	6,567,175	700,333
otal.....	26,414,285	3,336,570	36,364,528	4,638,093

Cut tacks, brads, and sprigs—Rates of duty.

Par.	Tariff classification or description.	Rate of duty, specific and ad valorem.
159	Cut tacks, brads, or sprigs, not exceeding 16 ounces to the thousand.	2½ cents per thousand.
	Exceeding 16 ounces to the thousand.....	3 cents per pound.
177	Cut tacks, brads, or sprigs, not exceeding 16 ounces to the thousand.	2½ cents per thousand.
	Exceeding 16 ounces to the thousand.....	2½ cents per pound.
149	Cut tacks, brads, or sprigs of all kinds.....	25 per cent ad valorem.
164	Cut tacks, brads, or sprigs, not exceeding 16 ounces to the thousand.	1½ cents per thousand.
	Exceeding 16 ounces to the thousand.....	1½ cents per pound.
163	Cut tacks, brads, or sprigs, not exceeding 16 ounces to the thousand.	⅛ cent per thousand
	Exceeding 16 ounces to the thousand.....	⅛ cent per pound.
554	Cut nails and cut spikes of iron or steel, horseshoe nails, horseshoe nail rods, hobnails, and all other wrought-iron or steel nails not not specially provided for in this section; wire staples, wire nails made of wrought-iron or steel, spikes, and horse, mule, or ox shoes, of iron or steel, and cut tacks, brads, or sprigs.	Free.

Wire staples—Rates of duty.

Par.	Tariff classification or description.	Rate of duty, specific and ad valorem.
.....	Not specified.....	
.....	do.....	
.....	do.....	
.....	do.....	
.....	do.....	
554	Wire staples (see above).....	Free.

WOOD SCREWS.

SUMMARY.

The value of the product of the 12 establishments engaged primarily in the production of wood screws in the United States in 1914 was $6,217,000. Four of these establishments were in Connecticut, the others in Illinois, Massachusetts, Rhode Island, Ohio, and Pennsylvania.

The chief raw material used is iron or steel wire. Production is by automatic machinery. These two facts favor the American industry in international competition.

Imports during the 12 years 1907–1918 were negligible, compared with domestic production. Exports in 1919 were valued at $2,737,716. More than half of these exports went to British India, Japan, China, and Australia. The rest went mainly to France, Spain, Canada, Mexico, Cuba, Argentina, Brazil, Chile, and British South Africa.

The leading foreign producers before the war were Great Britain and Germany.

A uniform ad valorem rate of 25 per cent was imposed on wood screws of iron or steel by the act of 1913. Earlier acts imposed specific duties. The average computed ad valorem rate during the years 1907 to 1913 varied from 38.29 per cent in 1907 to 74.61 per cent in 1909.

Wood screws—Summary table.

Year.[1]	Domestic production.[2]	Imports for consumption.	Domestic exports.	Ratio to production (per cent).		Value (Imports for consumption).	Amount of duty.	Value per pound.	Actual or equivalent ad valorem rate.
				Imports.	Exports.				
		Pounds.							*Per cent.*
1910	$5,641,005	17,856		[4] 0.016		$1,053	$577	$0.060	54.78
1911		55,513				1,984	1,079	.056	54.38
1912		40,233			[5] 3 to 5	2,270	1,212	.056	53.39
1913		50,774				2,314	1,529	.046	66.10
1914	6,572,512	8,027		[4] .089		590	220	.066	37.35
1915		4,806				326	82	.068	25.00
1916		17,111				1,249	312	.073	25.00
1917		987				274	69	.278	25.00
1918		9,573	[3] $1,870,146			1,800	450	.192	25.00
Calendar years:									
1918		11,411	2,908,264			927	232	.081	25.00
1919		1,778	2,737,716			507	127	.282	25.00

[1] Fiscal years ending June 30.
[2] Census years. Includes only establishments engaged primarily in the manufactures of screws, and some establishments making also nuts, bolts, and rivets.
[3] Estimate by Wm. S. Smythe, of the American screw Co., in House tariff hearings, 1913.
[4] Per cent based on values. Imports include only wood screws of iron or steel.
[5] Not specified prior to 1918.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

140. Screws, commonly called wood screws, made of iron or steel, 25 per centum ad valorem.

DESCRIPTION.

his survey includes only wood screws of iron or steel, such as used in cabinet making and in carpenter work. Wood screws ther metal and machine screws, i. e., screws of milled iron, steel, s, or copper, for use in the manufacture of machinery and in metal k generally, are excluded. Wood screws run in length from fourth inch to 6 inches and are numbered according to increasing kness, as No. 0, No. 1, No. 2, No. 3, etc., to No. 30. They vary in finish, as bright, blued, dead black japanned, nickel-plated, rass-plated, and in the shape of the head, as flat-headed, round-led, or oval-headed. It will be seen that a very large number ombinations may result from these various sizes, finishes, and es.

DOMESTIC PRODUCTION.

he value of wood screws of iron or steel, brass, and bronze, uding some bolts, nuts, and rivets produced by plants engaged narily in the manufacture of screws, and the screws produced some establishments engaged primarily in other industries, unted in 1914 to $6,572,542.

laterials.—The chief raw material required is iron or steel wire arious sizes according to the thickness of the screws produced. erican manufacturers consequently are very advantageously ated in respect to raw material.

quipment.—Equipment consists primarily of automatic screw hines. These machines are an American invention and are pro-ed in this country. American machines have been exported to peting countries.

lethods of production.—Screws are made by automatic machines which blanks are supplied in mass by the operator. The ma-ne handles each blank and produces finished screws with won-ful rapidity, regularity, and precision. The machines are complex costly, requiring a heavy original investment in plant involving e overhead charges.

rganization.—The twelve establishments engaged primarily in ducing screws in 1914 had a capital of $10,539,000 and employed 6 wage earners. Of these wage earners 3,233, or 72 per cent, e employed in two establishments, and 455, or 10.2 per cent, in hird establishment. That is to say, more than four-fifths of the l number of wage earners in the industry were employed by three s. The total value of the output of the 12 establishments was 17,000, and of this $5,123,000, or approximately five-sixths, was duced by establishments having an output valued at $1,000,000 nore. These figures show a highly concentrated condition in the ustry. The Roster of the Hardware Manufacturers' Organiza-n for War Service (1918) lists 26 firms producing wood screws.

eographical distribution.—The census of 1914 shows 4 establish-nts in Connecticut, 2 each in Illinois, Massachusetts, and Rhode nd, and 1 each in Ohio and Pennsylvania. The Roster of the rdware Manufacturers' Organization for War Service (1918) lists establishments in Connecticut, 4 in Pennsylvania, 3 each in Ohio l Massachusetts, and 2 each in New York, Rhode Island, and nois.

History of the industry.—Before 1836 wood screws were little known or used, having been rudely made by hand with imperfect tools. In 1836 an American invented a machine which performed much of the work automatically. In 1846 the screw industry was revolutionized by the invention of machines entirely automatic. Throughout the history of the screw industry since the adoption of the automatic machines there have been on the one hand attempts at control of the industry and maintenance of high prices, and on the other hand undue expansion, overproduction, and ruinous competition.

Domestic production and consumption.—Domestic production exceeds domestic consumption, as is shown by import and export statistics. As against domestic production valued at $6,572,542 in 1914, the maximum imports during the period 1907 to 1918 were in 1913, when they amounted to 50,774 pounds, valued at $2,314. Exports have been much larger. It was stated by a manufacturer at the tariff hearings of 1913 that the capacity for production at that time was 50 per cent greater than normal consumption.

Domestic exports.—Official export statistics are not available prior to 1918. In that year exports were valued at $1,870,146. Exports were considerable as early as 1911, in which year one manufacturer alone reports exports valued at $148,274. The same producer exported $620,350 worth in 1916.

Exports to British India alone in 1918 were valued at $485,690 and to Japan $360,414. Exports to China and Australia exceeded $100,000 each, and more than $40,000 worth each went to France, Spain, Canada, Mexico, Cuba, Argentina, Brazil, Chile, and British South Africa.

FOREIGN PRODUCTION.

Production of screws in the United Kingdom in 1907 was valued at £832,000, equal to $4,048,929 at normal exchange. This may and possibly does include machine screws as well as wood screws. In addition bolts, screws, and rivets not separately distinguished were produced to the value of £131,000, or $637,512. Other foreign production statistics are not readily available. It was stated at the tariff hearings in 1913 that the European market was for many years dominated by two trusts—one English and the other German. Each respected the other's market, the two parceling out the trade between them. One or two firms supplied the British market. It was also stated at those hearings that the foreign made screws were identical with those produced here and entirely acceptable to American trade.

IMPORTS.

Imports by countries of origin are not specified. Imports for consumption have been small, ranging in value during the 12 years, 1907–1918, from $205 in 1907 to $2,314 in 1913. The maximum quantity was 50,774 pounds in 1913, and the minimum 987 pounds in 1917.

PRICES.

On page 139 are given average yearly, quarterly, and monthly prices of 1-inch, No. 10, flat-head wood screws for the period 1913–1918. The average wholesale price of wood screws of this size and shape at New York was 10.75 cents per gross in 1913, 7.83 cents in 1914, and

33 cents in 1915. Then came a large increase to 16.83 cents in 1916 and 23.92 cents in 1917. In 1918 the price declined to 21.6 cents per gross.

TARIFF HISTORY.

The act of 1894 imposed a specific duty of 3 cents per pound on screws more than 2 inches in length; 5 cents per pound on screws over 1 inch and not more than 2 inches in length; 7 cents per pound on screws over one-half inch and not more than 1 inch in length, and 10 cents per pound on screws one-half inch and less in length. The act of 1897 retained the classification of 1894 and raised the rates to 4, 6, 8½, and 12 cents per pound, according to the respective lengths of the screws. The act of 1909 retained the same classification and reduced the rates to 3, 5, 8, and 10 cents per pound. The act of 1913 substituted for the specific rates varying with the length of the screws a flat ad valorem rate of 25 per cent. This represented a substantial reduction, the average ad valorem equivalent of the old specific rates having ranged in the seven years, 1907–1913, from a minimum of 38.29 per cent in 1907 to a maximum of 74.61 per cent in 1909. Whether or not this decrease in the tariff would have resulted in a substantial increase in imports if the European war had not interfered, it is impossible to say. The quantity of screws actually imported during the four years, 1915–1918, under the rate of 25 per cent of the act of 1913 was much smaller than the quantity imported during the four years, 1910–1913, under the higher rates of the act of 1909.

COMPETITIVE CONDITIONS.

Certain facts indicate that the American screw industry will probably not only hold its own in the domestic market, but retain its present foothold in the world markets. These facts are: (1) Production is by American made automatic machinery; (2) the chief raw material is iron or steel wire; (3) imports during the last 12 years have been negligible when compared with domestic consumption; (4) exports have been considerable for at least eight years and amounted in the calendar year 1919 to $2,737,716.

TARIFF CONSIDERATION.

Manufacturers in 1913 advocated the retention of specific duties, using the arguments that an ad valorem duty, being computed on the basis of the price of the imported commodity in the country of origin, subjects domestic manufacturers at all times to conditions in that foreign market which is for the time being most depressed, and that an ad valorem duty opens the way for evasion by undervaluation. It may be pointed out here that the specific duties resulted in some curiously uneven effects, which become apparent when the rates are reduced to an ad valorem equivalent. For example, the duty of 12 cents per pound imposed on screws one-half inch in length or less was in 1909 equivalent to 4.5 per cent ad valorem, and in 1910 to 20 per cent. The 10 cents per pound rate in 1911 was equivalent to 11.66 per cent and in 1913 to 2.2 per cent. The 8 cents per pound rate imposed on screws over one-half inch and not more than 1 inch in length was equivalent in 1910 to 128 per cent ad valorem, and in 1914

to 9.78 per cent. The 6 cents per pound rate on screws over 1 inch and not more than 2 inches in length was equivalent in 1907 to 33.64 per cent and in 1909 to 102.41 per cent. In part this lack of uniformity may be attributed to the small quantities imported, amounting in some cases to less than 10 pounds per year. In part, of course, it was due to fluctuations in foreign prices.

Wood screws [1]—Production in United States.

[From Federal Census.]

1899	$2,600,000	1909	$6,199,000
1904	2,134,000	1914	6,217,000

[1] Includes output of establishments engaged primarily in the manufacture of steel, iron, brass, and bronze screws for use in wood. Such products as bolts, nuts, and rivets were also reported in some instances.

Wood screws [1]—Production in United States.

[From Federal Census.]

1909	$142,000
1914	333,561

[1] Produced by establishments assigned to the industries "hardware, locks," "iron and steel bolts, butts, washers, and rivets," and "needles and pins and hooks and eyes."

Screws—Production in principal foreign countries.

Countries.	Screws, 1907.	Bolts, screws, and rivets not separately distinguished, 1907.
United Kingdom [1]	$4,048,929	$637,511

[1] United Kingdom, Census 1907.

Screws, wood—Imports for consumption—Revenue.

TOTAL.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and original ad valorem rate.
Fiscal years:		*Pounds.*				*Per cent.*
1907	4 to 8½ cents per pound.	1,358	$205	$78	$0.151	38.29
1908	4 to 6 cents per pound.	16,370	1,270	690	.078	54.25
1909	4 to 12 cents per pound.	18,516	1,030	761	.055	74.61
1910	3 to 12 cents per pound.	17,856	1,053	577	.060	54.77
1911	3 to 10 cents per pound.	35,513	1,984	1,076	.056	54.28
1912	do	40,233	2,270	1,212	.056	53.39
1913	do	50,774	2,314	1,520	.046	65.10
1914	3 to 10 cents per pound or 25 per cent ad valorem.	8,927	590	220	.066	37.33
1915	25 per cent ad valorem.	4,806	326	82	.068	25.00
1916	do	17,111	1,249	312	.073	25.00
1917	do	987	274	69	.278	25.00
1918	do	9,373	1,800	450	.192	25.00
Calendar years:						
1918	do	11,411	927	232	.081	25.00
1919	do	1,798	507	127	.282	25.00
1920	do	9,945	2,595	649	.261	25.00

Screws, wood—Imports for consumption—Revenue—Continued.

ONE-HALF INCH AND LESS IN LENGTH.[1]

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	12 cents per pound.	3	$8	$0.36	$2.67	4.50
.....	.....do.....	10	6	1.20	.60	20.00
.....	10 cents per pound.	118	46	11.80	.39	25.65
.....	.....do.....	40	36	4.00	.90	11.11
.....	.....do.....	6	11	.60	1.85	5.40
.....	.....do.....	11	50	1.10	4.55	2.20

OVER ONE-HALF INCH AND NOT MORE THAN 1 INCH IN LENGTH.

.....	8½ cents per pound.	270	$62.00	$22.96	$0.23	37.03
.....	.....do.....	10	4.00	.85	.400	21.25
.....	8 cents per pound.	8	.50	.64	.063	128.00
.....	.....do.....	26	7.39	2.08	.284	28.15
.....	.....do.....	31	18.26	2.48	.59	13.57
.....	.....do.....	86	61.00	6.88	.709	11.28
.....	.....do.....	22	18.00	1.76	.818	9.78

OVER 1 INCH AND NOT MORE THAN 2 INCHES IN LENGTH.

.....	6 cents per pound.	600	$107	$36.00	$0.178	33.64
.....	.....do.....	1,737	422	104.22	.243	24.69
.....	.....do.....	1,007	59	60.42	.059	102.41
.....	.....do.....	10	4	.60	.400	15.00
.....	5 cents per pound.	132	31	6.60	.235	21.29
.....	.....do.....	329	50	16.45	.153	32.64
.....	.....do.....	144	17	7.21	.118	42.41
.....	.....do.....	53	12	2.65	.226	22.08
.....	.....do.....	5	1	.25	.20	25.00

MORE THAN 2 INCHES IN LENGTH.

.....	4 cents per pound.	488	$36	$20	$0.074	54.22
.....	.....do.....	14,633	848	585	.058	69.02
.....	.....do.....	17,506	953	700	.054	73.48
.....	.....do.....	2,800	156	112	.056	71.80
.....	3 cents per pound.	14,768	805	443	.054	55.02
.....	.....do.....	35,118	1,891	1,054	.054	55.73
.....	.....do.....	40,052	2,223	1,202	.056	54.04
.....	.....do.....	50,624	2,191	1,519	.043	69.32
.....	.....do.....	4,528	241	136	.053	56.37

gures on p. 137 include only screws, commonly called wood screws, of iron or steel.
to Oct. 3, 1913.

Wood screws—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
ır:		*Pounds.*				*Per cent.*
.....	25 per cent.....	4,372	$330	$83	$0.075	25.00
.....	.....do.....	4,806	326	82	.068	25.00
.....	.....do.....	17,111	1,249	312	.073	25.00
.....	.....do.....	987	274	69	.278	25.00
.....	.....do.....	9,373	1,800	450	.192	25.00
year:						
.....	.....do.....	11,411	927	232	.081	25.00
.....	.....do.....	1,798	507	127	.282	25.00
.....	.....do	9,945	2,595	649	.261	25.00

1913, to June 30, 1914.

Wood screws, of iron or steel—Domestic exports.

Exported to—	1918 [1]	1918 [2]		1919 [2]	
	Value.	Gross.	Value.	Gross.	Valu
France	$46,304	285,266	$80,487	235,737	$6
Spain	78,877	397,607	99,797	98,938	2
Canada	88,100	358,565	92,053	114,919	3
Mexico	41,807	143,639	39,207	229,078	6
Cuba	67,208	249,598	72,045	224,868	6
Argentina	41,826	64,626	19,799	153,936	4
Brazil	85,922	270,814	77,699	643,018	18
Chile	59,804	133,838	36,206	163,683	4
China	105,106	523,350	132,262	671,239	19
British India	485,690	3,049,122	782,499	1,692,284	47
Japan	360,414	1,344,297	421,144	2,171,976	58
Australia	119,089	408,771	111,748	613,525	13
British South Africa	46,143	156,066	47,431	70,064	1
All other	243,856	1,490,690	355,888	3,417,658	82
Total	1,870,146	8,876,249	2,368,264	10,461,923	2,73

[1] Not specified prior to 1918. Fiscal years, ending June 30.
[2] Calendar years.

Wood screws, 1-inch, No. 10, flathead, prices per gross, wholesale, New York.

[From War Industries Board, Price Bulletin No. 33. Prices of iron, steel, and their products.]

	1913	1914	1915	1916	1917	19
Year	$0.1075	$0.0783	$0.0933	$0.1683	$0.2392	$0
Quarter:						
First	.1100	.0700	.1000	.1367	.2100	
Second	.1100	.0700	.1000	.1700	.2400	
Third	.1100	.0833	.0800	.1700	.2600	
Fourth	.1000	.0900	.0933	.1967	.2467	
Month:						
January	.1100	.0700	.1000	.1300	.2100	
February	.1100	.0700	.1000	.1300	.2100	
March	.1100	.0700	.1000	.1500	.2100	
April	.1100	.0700	.1000	.1700	.2400	
May	.1100	.0700	.1000	.1700	.2400	
June	.1100	.0700	.1000	.1700	.2400	
July	.1100	.0800	.0800	.1700	.2600	
August	.1100	.0810	.0800	.1700	.2600	
September	.1100	.0900	.0800	.1700	.2600	
October	.1000	.0900	.0800	.1900	.2600	
November	.1000	.0910	.1000	.1900	.2600	
December	.1000	.0900	.1000	.2100	.2200	

Court and Treasury Decisions.

Screw spikes of metal intended for fastening rails to ties and ha neither a slotted head nor point, were declared not commonly ca wood screws and were held dutiable as manufactures of metal u the act of 1897. (G. A. 5823, T. D. 25711.) Screws for bic were furthermore held not commonly called wood screws under act of 1890. (G. A. 2683, T. D. 15157.)

Wood screws—Rates of duty.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
83	181	Screws, commonly called wood screws, 2 inches or over in length.	6 cents per pound.
		1 inch and less than 2 inches in length	8 cents per pound.
		Over ½ inch and less than 1 inch in length	10 cents per pound.
		½ inch and less in length	12 cents per pound.
90	184	Screws, commonly called wood screws, more than 2 inches in length.	5 cents per pound.
		Over 1 inch and not more than 2 inches in length	7 cents per pound.
		Over ½ inch and not more than 1 inch in length	10 cents per pound.
		½ inch and less in length	14 cents per pound.
94	155	Screws, commonly called wood screws, more than 2 inches in length.	3 cents per pound.
		Over 1 inch and not more than 2 inches in length	5 cents per pound.
		Over ½ inch and not more than 1 inch in length	7 cents per pound.
		½ inch and less in length	10 cents per pound.
97	169	Screws, commonly called wood screws, made of iron or steel, more than 2 inches in length.	4 cents per pound.
		Over 1 inch and not more than 2 inches in length	6 cents per pound.
		Over ½ inch and not more than 1 inch in length	8½ cents per pound.
		½ inch and less in length	12 cents per pound.
09	169	Screws, commonly called wood screws, made of iron or steel, more than 2 inches in length.	3 cents per pound.
		Over 1 inch and not more than 2 inches in length	5 cents per pound.
		Over ½ inch and not more than 1 inch in length	8 cents per pound.
		½ inch and less in length	10 cents per pound.
13	140	Screws, commonly called wood screws, made of iron or steel	25 per cent ad valorem.

CORSET CLASPS, CORSET STEELS, DRESS STEELS, AND FLAT WIRES.

SUMMARY.

At the present time (1920) corset clasps, corset and dress steels and flat wires are imported by the United States chiefly from England. Prior to the war (1914–1918) these articles were sold in the United States by Germany to an extent equal to or exceeding the amounts from England.

From the standpoint of competition with foreign countries, corset clasps and corset and dress steels do not appear to be of much importance, and flat wire from England is competitive mostly in the higher grades.

Since the war, Germany, at least for the time being, has ceased to be a competitive factor, and the English products continue to be sold in this country principally upon the strength of quality, which is claimed by British wire manufacturers to be better than the American. British manufacturers do not expect to compete with American manufacturers on a purely price basis, but they do expect to continue to sell their special high-grade products in the United States, as they do not consider the American tariff a serious obstacle.

The making of corset clasps and corset and dress steels, and the manufacture of flat wire are separate industries. The most important of these industries is the manufacture of flat wire, since this is the chief raw material for the production of the other articles. This industry is really a branch of the wire trade but presents special features, owing to the fact that the output is small as compared with the large production of ordinary round wire and involves a larger amount of skilled labor. Its further manufacture into corset clasps and corset and dress steels is a simple operation employing chiefly unskilled labor.

The industries are located mostly in the northeastern industrial section of the United States, and the producing capacities of the factories are amply sufficient to satisfy any domestic demands that may be made upon them.

Corset clasps, corset steels, dress steels, and flat wires, not thicker than No. 15 wire gauge—Summary table.

Year.[1]	Value (imports for consumption).	Amount of duty.	Value per pound.	Actual or equivalent ad valorem rate.
				Per cent.
1910	$77,473	$27,322	$0.115	35.27
1911	100,187	38,613	.137	38.53
1912	131,806	46,339	.190	35.16
1913	9,693	4,392	.....	45.31
1914	78,947	11,845	.....	15.00
1915	78,329	11,749	.....	15.00
1916	61,312	9,197	.....	15.00
1917	97,076	14,561	.....	15.00
1918	17,238	2,586	.....	15.00
1919	247,103	37,065	.....	15.00
1920	362,347	54,352	.....	15.00

[1] Fiscal years ending June 30.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

Paragraph 114.— * * * corset clasps, corset steels, dress eels, and all flat wires and steel in strips not thicker than No. 15 re gauge and not exceeding 5 inches in width, whether in long or ort lengths, in coils or otherwise, and whether rolled or drawn rough dies or rolls, or otherwise produced; * * * 15 per ntum ad valorem.

DESCRIPTION.

Corset clasps consist of comparatively short pieces of flat steel res having firmly affixed small metal posts, on the one hand, and t metal eyelets on the other, so arranged that the eyelets can be oked over the posts, and, thus forming a fastening for the two ends a corset when attached upon the person.

Corset steels, or stays, are short strips of flat steel wire covered th paper, cotton gauze, or other material, employed as a stiffening r corsets.

Dress steels, or stays, are short strips of flat steel wire covered with aper, cotton gauze, or other material, employed as a stiffening for esses. Dress steels are very similar to corset steels.

Flat wire of No. 15 gauge is .05707 inch in thickness, according the American, or Brown & Sharpe, wire gauge, which is recognized standard by the United States Government (T. D. 34701).

Flat wire is usually made in four tempers: (1) *Hard rolled* for flat ork and easy punching; (2) will bend right angle across the grain;) medium soft. Will bend down upon itself across the grain and irly well with the grain; (4) dead soft. For difficult cupping and vere work. Will bend down upon itself both ways of the grain. *igh carbon spring steel* is a special grade made of high carbon open-earth steel; this is used mostly for clock, watch, and phonograph otor springs, and also for any other purpose where flat wire is quired either hard rolled, untempered, or oil tempered. Wire ed for corset and dress steels comes under this head.

Whalebone is a substitute for flat wire in the manufacture of rsets and dress stays which at one time was used almost exclusively r these purposes. Whalebone is considered superior to steel for rset and dress stays, but as its cost is much higher than steel its se has been greatly reduced, and is employed at the present time nly in corsets of very high grade.

Another substitute is cold-rolled strip steel, generally manufactured very wide strips, in some instances as wide as 16 inches. These rips are reduced to thickness by means of cold rolling, and the roduction of the narrower widths is accomplished by slitting up e wide strips into narrow widths, or steel in strips. Flat wire and eel in strips meet in competition in our domestic market.

DOMESTIC PRODUCTION.

There are about 20 or 25 establishments in the United States pro-ucing flat wire, and possibly 10 or 15 establishments producing corset asps, corset steels, and dress steels. The industries are located iefly in the northeastern industrial section of the country. The

amount and value of the total annual output is not known. Some wire establishments produce as much as 25,000 to 30,000 tons of flat wire annually.

Raw materials.—Corset clasps, corset steels, and dress steels are made from flat wire. Flat wire is made from both low-carbon and high-carbon open-hearth steel rods furnished in long-length coils. Most manufacturers purchase this material from domestic mills, though some produce it in their own establishments. The supply of wire rods is abundant, and the American manufacturer is at no competitive disadvantage with foreign makers of flat wire in procuring sufficient supplies from domestic sources for his needs.

Equipment.—Before the war (1914–1918) some equipment was imported from foreign countries, but in recent years practically all the equipment used in the United States originated in America, being produced to a large extent in the establishments of the manufacturers themselves. There is no apparent advantage in importing foreign-made equipment.

Methods of manufacture.—The manufacture of *flat wire* is accomplished by taking long-length coils of hot-rolled steel, which is the product of a wire-rod mill or a hoop and band mill. These coils of long-length hot-rolled steel, whether in the form of flat, triangular, or round, are cleaned to remove scale, and then by successive rolling or drawing cold, through rolls of dies, are reduced to the size desired. Between the successive rollings or drawings intermediate annealings are required to facilitate the reduction to size and to procure the proper quality. The edges of the strips are trimmed in slitting machines or edge rolled by a specially constructed edge-rolling apparatus attached to the rolling machine, depending upon the customer's specifications. The resulting product is flat wire in long-length coils, usually ranging in weight from 50 to 200 pounds each.

When the finished material is wanted for use in short lengths, these long-length coils are run through a straightening machine and cut to specified lengths.

All the work is done with power machines, little or no handwork being necessary other than the stringing up of the machines and the removal of material from the machines. This work is all done by male labor in both the United States and foreign countries, as the coils of finished wire are too heavy for either child or female workers.

Besides being made from flat wire, corset and dress steels are also made from round spring-steel wire woven in various sizes and flattened by rolling. After the rolled wire is of lengths desired the rough ends are covered with smooth metal tips to prevent injury to the fabric of the corset or dress. These steels are more flexible than other flat wire steels, as they easily bend in any direction and have the advantage, when worn in a corset or dress, of conforming to every motion of the body.

The method of producing flat wire is approximately the same throughout the world.

Flat steel wire is made in various finishes, such as bright, black annealed, bright annealed, tinned, japanned, galvanized, blued, and coppered, and with either round or square edges.

Organization.—The manufacture of flat wire requires large facilities and capital, a highly developed organization, and a large market

the efficient and economical conduct of the industry. All of these ditions prevail in this country at the present time (1920).

The domestic flat-wire industry is divided among about 20 or 25 cerns, most of which also make wire in round, oval, square, tri-ular, and various other shapes, and wire rope and wire specialties.

eographical distribution.—The industries are located chiefly in York, Pennsylvania, Connecticut, Massachusetts, New Jersey, Rhode Island.

istory of the industry.—The manufacture of flat wire was first intro-ed in the United States by one manufacturer about 40 years ago. ce then it has grown until there are now (1920) 20 or 25 establish-nts of considerable importance, one establishment having, in 1920, proximately 300 machines in operation. The growth of the indus- follows closely the development of American manufacture in eral, as flat wire is employed in connection with the manufacture many articles. It is claimed by American manufacturers that hout tariff protection the development of the industry in the ited States would have been greatly curtailed.

Domestic production and consumption.—Statistics of the total ount and value of American annual production are not available. mestic production is, however, abundantly sufficient to supply the mestic demand, and the manufacturing facilities are sufficient to nish some for export.

Domestic exports.—Statistics of total exports are not available. e manufacturer reports small shipments of flat wire annually to nada.

FOREIGN PRODUCTION.

Outside of the United States flat wire is produced chiefly in Ger-ny, England, Sweden, France, and Switzerland, ranking in impor-ce as competitors of America in about the order named.

The manufacture of wire in the United Kingdom has been estab-ed for over 100 years, and until about 1880 that country was prac-ally the only producer of wire and wire products in the world. The ustry in Germany was established just prior to 1890, and 10 years r the United States began the manufacture on a large scale. h Germany and the United States concentrated on the production arge quantities of comparatively heavy material and soon out-pped the United Kingdom in the manufacture of bulk lines. United Kingdom, however, still maintains its supremacy in the ufacture of special products, among which is flat wire.

Most of the wire mills in the United Kingdom are located in the nity of Manchester and, while there has been no particular increase ire drawing capacity, the new equipment installed in late years recent design.

British manufacturers claim that the English wire is produced at ier cost and is better than the wire produced in the United States in Germany. The higher cost is due in part to inferior equipment, more particularly to the greater attention paid to the quality and ge of wire.

The methods employed in Germany are far less efficient than those England, and the low cost of the German product prior to the war 14–1918) is attributed wholly to the low wages paid on the Con-nt and the poor quality of the product.

IMPORTS.

In the fiscal year 1920, the total imports of corset clasps, and dress steels, and flat wires not thicker than No. 15 gauge am to $362,347. This was over three and one-half times as large prewar importation in 1914 ($78,947), and nearly three times t as the largest importation for any year prior to 1914 for statistics are available. After the beginning of the war in the amounts decreased, amounting to only $17,238 in 1918. after the armistice, in 1918, imports began to increase, reach above high record in 1920.

The Department of Commerce statistics do not show the co of origin of these products, but the imports come chiefly from E and Germany.

TARIFF HISTORY.

The act of 1894 imposed an ad valorem duty of 40 per c steel corset wire and flat steel wire, and provided, also, that manufactured from iron or steel wire should pay the maximu of duty imposed upon any wire used in the manufacture o articles and in addition thereto 1 cent per pound.

The act of 1897 changed the wording of the old paragrap mentioned corset clasps, corset steels, and dress steels, besid viding for wire of material other than iron or steel, and li the thickness of these articles to a maximum of 0.025 inch. valorem rate was increased to 45 per cent, and provision wa requiring the payment of the rate of duty imposed upon th used in the manufacture of articles plus 1¼ cents per pound, the wire was coated with metal an additional two-tenths of per pound was required. Also an additional 1 cent per pou added to strips of iron or steel of certain special manufacture. gether the requirements in the law were complicated, and the s imported bore various rates of duty. The average rate or imports, when computed on an ad valorem basis, remained the same as under the old rate.

The act of 1909 again changed the wording of the para besides making some reduction in the rates. Annual imports, this act, increased to over 100 per cent above the imports un old law, and the amount of revenue derived was also larger.

The act of 1913 simplifies the wording of the paragrap provides a straight ad valorem rate of 15 per cent applicabl the various articles. Official statistics show that annual i decreased greatly in the five years immediately following the ment of the law. The cause of the decrease, however, is trace disturbed international trade conditions, as a direct result World War. Shortly after the armistice, in 1918, imports increased, and in the fiscal years 1919 and 1920 amounted largest on record. The total revenue derived in 1920 also am to the largest on record.

COMPETITIVE CONDITIONS.

There is apparently very little foreign competition in corset or in corset and dress steels in the domestic market. Th ticles are made from flat wire and are mainly worked up by tic manufacturers. The requisite operations, cutting the wi

ting on the trimmings, are simple and require little labor and t labor chiefly unskilled.

n the flat wire trade, however, there is some foreign competi- n in this market. The manufacture of this article, whether by ing or drawing through dies, calls for considerable skill, especially the production of the better grades, such as those used in the nufacture of corset and dress steels. While the production of wire may be considered as a branch of the wire trade the out- is relatively small as compared with that of ordinary round e, and a relatively much larger proportion of labor is required in manufacture. Whereas in producing round wire in large quan- es, the matter of equipment is a more vital factor than low wages reducing costs, labor enters more largely into the calculation in case of flat wire. Wages in all the principal producing coun- s—the United States, England, and Germany—have advanced atly since 1914. In England these advances have been partly t by increased plant efficiency, and production there is now more rly in accordance with American methods than it was before the r. In Germany, the low production cost of wire products, gen- lly, was due to low wages rather than to up-to-date equipment. e competitive strength of Germany is adversely affected by the of its important sources of ore supply, and it is doubtful if the nt facilities for rolling and drawing steel wire rods and wire have proved to the same extent as they have in England. It has not yet been demonstrated whether the very low wages still obtain- in Germany owing to the depreciated currency in that country offset its postwar disadvantages in equipment.

he quality of British flat wire is equal or superior to that of the erican product and its sales in the United States are attributed nly to its alleged better quality since its cost delivered in country has usually been not materially lower than that le by American makers. German wire is inferior to the English duct and competes in all markets with English and American e on the basis of relative cheapness.

British manufacturers have no hope of being able to compete with erican wire makers on a purely price basis. They do, however, ect to continue to sell certain of their specialties in the United tes.[1] It would seem, therefore, that the tariff on wire products eneral is not an important feature in limiting the imports from United Kingdom.

TARIFF CONSIDERATIONS.

he present tariff limits flat wire to No. 15 wire gauge, and in th not exceeding 5 inches. It is felt by some manufacturers the dimensions should be extended to include No. 8 wire gauge own & Sharpe), and in width up to 6½ inches. If separate consider- n is to be given in the tariff as to different grades, then under ow carbon" a classification for Bessemer, basic and acid steel ht be made where the material runs less than 30 per cent carbon, another classification for "High carbon" covering Bessemer, c and acid steel 30 per cent carbon and higher.

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[1] ul M. Tyler, special agent of the United States Tariff Commission to England.

Total, corset clasps, etc.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907		454,343	$52,083	$23,608	$0.115	45.33
1908		327,841	44,895	20,264	.137	45.14
1909		71,280	13,565	6,164	.19	45.44
1910			77,473	27,322		35.27
1911			109,187	38,613		35.36
1912			131,816	46,339		35.16
1913			9,693	4,392		45.32
1914			78,947	11,845		15.00
1915			78,329	11,749		15.00
1916			61,312	9,197		15.00
1917			97,076	14,561		15.00
1918			17,238	2,586		15.00
1919			247,103	37,065		15.00
1920			362,347	54,352		15.00

Corset clasps, corset steels, and dress steels, and sheet steel in strips, twenty-five one-thousandths of an inch thick or thinner, whether uncovered or covered with cotton, silk, metal, or other material, cold rolled, etc., blued, brightened, tempered, etc.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	45 per cent plus 1 cent per pound.	17,028	$3,343	$1,675	$0.196	50.09
1908	do	5,986	1,475	724	.248	49.08
1909	do	5,956	811	425	.136	52.34

Corset clasps, corset steels, and dress steels, and sheet steel in strips, twenty-five one-thousandths of an inch thick or thinner, whether uncovered or covered with cotton, silk, metal, or other material, coated with zinc or tin, or any other metal.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1908	35 cent per pound plus 45 per cent.	657	$441	$21	$0.067	47.98

Corset clasps, corset steels, and dress steels, and sheet steel in strips, twenty-five one-thousandths of an inch thick or thinner, whether uncovered or covered with cotton, silk, metal, or other material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	45 per cent	437,315	$48,740	$21,933	$0.111	45
1908	do	321,198	43,376	19,519	.135	45
1909	do	65,325	12,754	5,739	.196	45
1910[1]	do	3,185	940	423	.295	45

[1] July 1 to Aug. 5, 1909, under act of 1897.

t clasps, corset steels, dress steels, and all flat wire, and steel in strips not thicker n No. 15 wire gauge and not exceeding 5 inches in width, whether in long or short gths, in coils or otherwise, and whether rolled or drawn through dies or rolls or erwise produced, cold hammered, blued, brightened, tempered, etc.—Imports for sumption—Revenue.

cal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$\frac{1}{8}$ cent per pound plus 35 per cent.	28,227	$5,871	$2,168	$0.208	36.92
.....	.....do.....	99,268	19,158	7,102	.193	37.07
.....	.....do.....	51,614	7,886	2,967	.153	37.62
.....	$\frac{1}{16}$ cent per pound plus 45 per cent.	7,427	1,214	576	.163	47.44

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909. [2] Treasury Decision 32600.

t clasps. corset steels, dress steels, and all flat wire, and steel in strips not thicker than . 15 wire gauge and not exceeding 5 inches in width, whether in long or short lengths, coils or otherwise, and whether rolled or drawn through dies or rolls or otherwise pro- ed—Imports for consumption—Revenue.

cal year:	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
.....	35 per cent.....	.....	$70,662	$24,732	.....	35
.....	..... do.....	.....	90,029	31,510	.....	35
.....	.....do.....	.....	123,920	43,372	.....	35
.....	45 per cent.....	.....	8,479	3,816	.....	45
.....	.....do.....	.....	11	5	.....	45
.....	15 per cent.....	.....	78,936	11,840	.....	15
.....	.....do.....	.....	78,329	11,749	.....	15
.....	.....do.....	.....	61,312	9,197	.....	15
.....	.....do.....	.....	97,076	14,561	.....	15
.....	.....do.....	.....	17,238	2,586	.....	15
.....	.....do.....	.....	247,103	37,065	.....	15
.....	.....do.....	.....	362,347	54,352	.....	15

:. 6, 1909, to June 30, 1910, under act of 1909.
asury Decision 32600.
r 1 to Oct. 3, 1913, under act of 1909.
. 4, 1913, to June 30, 1914, under act of 1913.

Corset clasps, corset steels, dress steels, and flat wires—Rates of duty.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
182	Iron or steel wire, smaller than No. 5 and not smaller than No. 10 wire gauge.	1½ cents per pound.
	Smaller than No. 10 and not smaller than No. 16 wire gauge..	2 cents per pound.
	Smaller than No. 16 and not smaller than No. 26 wire gauge..	2½ cents per pound.
	Smaller than No. 26 wire gauge.....	3 cents per pound.
	Provided, That iron or steel wire covered with cotton, silk, or other material, and wire commonly known as crinoline, corset, and hat wire shall pay 4 cents per pound in addition to the foregoing rates.	
148	* * * *Provided*, That iron or steel wire covered with cotton, silk, or other material, and wires or strip steel, commonly known as crinoline wire, corset wire, and hat wire shall pay a duty of.	5 cents per pound.
	And provided further, That flat steel wire, or sheet steel in strips, whether drawn through dies or rolls, untempered or tempered, of whatsoever width, twenty-five one-thousandths of an inch thick or thinner (ready for use or otherwise), shall pay a duty of.	50 per cent ad valorem.

Corset clasps, corset steels, dress steels, and flat wires—Rates of duty—Contin

Act of—	Par.	Tariff classification or description.	Rates of duty and ad val
1894	124	* * * wire or strip steel, commonly known as crinoline wire, corset wire, * * * and all steel wires, whether polished or unpolished, in coils or straightened, and cut to lengths, drawn cold through dies, and hat wire, flat steel wire, or sheet steel in strips, uncovered or covered with cotton, silk, or other material, or metal, and all the foregoing manufactures of iron or steel, of whatever shape or form, valued above 4 cents per pound, shall pay a duty of.	40 per cent ad
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto.	1 cent per pou
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad v
1897	137	* * * Iron or steel or other wire not specially provided for in this act, including such as is commonly known as hat wire, or bonnet wire, crinoline wire, corset wire, * * * whether flat or otherwise, and corset clasps, corset steels, and dress steels, and sheet steel in strips, twenty-five one-thousandths of an inch thick or thinner, any of the foregoing, whether uncovered or covered with cotton, silk, metal, or other material, valued at more than 4 cents per pound.	45 per cent ad v
		Provided, That articles manufactured from iron, steel, * * * wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1¼ cents per pound * * *.	
1909	135	* * * all wire composed of iron, steel, or other metal except gold or silver, covered with cotton, silk, or other material, corset clasps, corset steels, dress steels, and all flat wires, and steel in strips, not thicker than No. 15 wire gauge and not exceeding 5 inches in width, whether in long or short lengths, in coils or otherwise, * * * and all other wire not specially provided for in this section, shall pay a duty of not less than.	35 per cent ad v
1909	199	Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad v
1913	114	* * * wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material: corset clasps, corset steels, dress steels, and all flat wires and steel in strips not thicker than No. 15 wire gauge and not exceeding 5 inches in width, whether in long or short lengths, in coils or otherwise, * * * all other wire not specially provided for in this section, and articles manufactured wholly or in chief value of any wire or wires provided for in this section; all the foregoing.	15 per cent ad v

OVEN WIRE FENCING AND POULTRY NETTING.

SUMMARY.

n wire fencing and poultry netting to the value of approxi-
35,000,000 was produced in the United States in 1914. The
is centered largely in Indiana, Illinois, and Ohio. Import
are available only for woven wire fencing since 1914. Dur-
fiscal years 1914–1918, inclusive, imports of woven wire
aggregated less than $25,000 in value. During the same
ports of woven wire fencing aggregated more than $3,800,000.
wire fencing is admitted free of duty; poultry netting is
at 15 per cent ad valorem.
ny, England, and France were important producers before
. American manufacturers have an advantage over pro-
n those countries in a more abundant and cheaper supply of
raw materials—iron or steel wire and zinc for galvanizing.

Woven wire fencing and poultry netting—Summary table.

ir.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.[1, 3]		Value (imports for consumption).[2]	Value per unit of quantity.	Actual or equivalent ad valorem rate.
				Imports.	Exports.			
		Pounds.		*Per cent.*	*Per cent.*		*Per pound.*	
			$355,836					
	[4] $33,324,518	[4] 32,710	354,841	0.098	1.06	[5] $736	$0.023	Free.
		282,294	429,866			8,315	.039	Do.
		298,745	648,880			9,136	.031	Do.
		36,150	1,575,137			1,002	.028	Do.
		72,197	837,621			3,585	.050	Do.
		3,210	1,036,730			368	.115	Do.
		136,637	933,143			6,454	.047	Do.

ar.
d wire fencing only. Imports not specified prior to 1914.
re fencing. Quantity not specified. Value not specified prior to 1913.
en wire fencing and poultry netting made in various sorts of establishments. The figures
alue of some other wire work produced by woven wire fencing manufacturers.
es based on values.
3, to June 30, 1914.

GENERAL INFORMATION.

TARIFF PARAGRAPHS, ACT OF 1913.

45. * * * Galvanized wire fencing composed of wires not
an twenty one-hundredths of 1 inch in diameter nor smaller
it one-hundredths of 1 inch in diameter, * * * (free).
14. * * * Articles manufactured wholly or in chief value
re or wires provided for in this section; * * * 15 per cent
m.

DESCRIPTION.

Woven wire fencing and poultry netting are two similar products woven from iron or steel wire. The former designed primarily for turning hogs, sheep, cattle, etc., is made of heavier wire than the latter, which is designed primarily to turn only poultry or other small animals. Woven wire fencing is composed of wires practically all falling between the sizes specified in paragraph 645 and is therefore admitted free. But poultry netting is composed almost, if not quite altogether, of wire smaller than 0.08 inch in diameter and is therefore not free of duty under paragraph 645, but is dutiable at 15 per cent under paragraph 114. Wire 0.08 inch in diameter is according to Roefling's and Washburn and Moew's wire gauge, No. 14, and according to Brown and Sharp's, No. 12. Most poultry netting is composed of wire No. 19 or smaller. It was evidently the intention of Congress to admit woven wire fencing free and retain poultry netting on the dutiable list. The two articles are united for discussion in this catalogue because of their similarity, and for statistical convenience being grouped together in the census.

Woven wire fencing is, because of its superiority and cheapness, displacing rail and board fences, barbed wire fences, and hedge fences in the United States.

DOMESTIC PRODUCTION.

Domestic production of woven wire fencing and poultry netting in the United States in 1914 was valued at $35,000,000. It is an industry of importance to agriculture, making possible more economical utilization of farm lands than would otherwise be possible.

Materials.—The chief materials requisite are iron or steel wire and zinc for galvanizing, both of which are produced more abundantly in the United States than in any other country.

Methods of production.—Woven wire fencing and poultry netting, as well as their chief raw material—wire—are made by machine processes. In the case of wire netting the machines take the wire from bobbins and deliver the netting complete in rolls ready for shipping.

Organization.—Woven wire fencing to the value of $15,132,000 was produced in 1914 in establishments devoted primarily to the manufacture of that article. There were 76 such establishments with a capital of $12,027,000, employing 2,598 wage earners. In addition woven wire fencing and poultry netting to the value of $13,032,343 was produced in wire departments of rolling mills and to the value of $6,763,469 in wire mills. Approximately $500,000 worth of woven wire fencing in addition was produced by other industrial establishments.

Geographical distribution.—The census of 1914 does not show the geographical location of the industry. There are 41 firms listed by Thomas' Register of American Manufacturers under the head of "Fences, woven wire." Of these 9 are in Illinois, 6 in Indiana, 4 in Ohio, and 3 each in Michigan and Pennsylvania. The others are in Alabama, Connecticut, Kansas, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, New York, and Wisconsin.

The e are 27 establishments listed by Thomas' Register of American Manufacturers under the head of "Netting; wire, poultry, etc." f those, 5 are in New York, 4 in Indiana, 3 each in California, Ohio nd New Jersey. The others are in Connecticut, Illinois, Massachuetts, Maryland, Missouri, and Pennsylvania.

Domestic production and consumption.—Import and export statistics indicate that production exceeds consumption. Aggregate mports of woven wire fencing (not including poultry netting) from 914 to 1918, inclusive, amounted to less than $25,000, while exports f woven wire fencing aggregated over $3,800,000.

Domestic exports.—Domestic exports of poultry netting are not pecified and of woven wire fencing were not specified prior to 1913, n which year they amounted, in round numbers, to $356,000. In 914 they remained approximately the same, in 1915 they rose to 430,000, in 1916 to $649,000 and in 1917, to $1,575,000, dropping n 1918 to $838,000. Except in 1917 when exceptionally heavy hipments were made to France, exports to Europe have been less han to North America. Exports to South America, Asia, and Oceania showed a marked increase during 1916–1918 over earlier ears.

The twelve leading countries to which we export woven wire fencng are shown on page 155. Exports to Canada each year from 1913 o 1916, inclusive, were greater than to any other country, but in 917 Canada was second to France and in 1918 second to Cuba. he six leading countries in 1913 were in order, Canada, Argentina, uba, Dutch East Indies, Mexico, and England, with exports ranging om $114,395 to Canada down to $12,763 to England. In 1918 the ix leading countries were Cuba, Canada, France, Australia, Chile, nd Dutch East Indies with exports ranging from $162,539 to Cuba own to $46,078 to the Dutch East Indies.

FOREIGN PRODUCTION.

According to the Iron and Coal Trade Review, the annual produc- on of wire netting in Great Britain before the war had reached an pproximate value of $3,400,000 (about 35,000 tons). According the same authority, British producers were then handicapped competition by the necessity of importing wire and spelter. rmany was a heavy producer of wire netting before the war, and d built up a large export trade.

IMPORTS.

Imports of poultry netting are not specified. Imports of woven re fencing are specified only since October 4, 1913, under the head galvanized wire fencing composed of wire not larger than $\frac{70}{1000}$ ch nor less than $\frac{8}{1000}$ inch in diameter. Imports of this article r consumption from October 4, 1913, to June 30, 1914, were 32,710 unds valued at $736, and in 1918, 72,197 pounds valued at $3,585. ie greatest imports specified in any one year were in 1916 when ey were 298,745 pounds valued at $9,136. Such small imports are gligible, amounting to only a small fraction of 1 per cent of domestic oduction.

TARIFF HISTORY.

By the tariff acts of 1894, 1897, and 1909, woven wire fencing and poultry netting paid duties made up of the rates paid upon the wire from which they were manufactured and an additional specific duty as manufactures of such wires. By the act of 1894 the duty ranged from 2½ to 3 cents per pound, with the proviso that the duty should not be less than 40 per cent ad valorem on the wire if valued about 4 cents per pound and 1 cent per pound. By the act of 1897, the rate ranged from 2½ cents to 3¼ cents per pound with an additional duty of $\frac{3}{10}$ cent per pound if the article was made of galvanized wire, with the proviso that the duty on the manufactured article should not be less than 40 per cent ad valorem on the wire it contained, if valued at more than 4 cents per pound, and 1¼ cents per pound additional. By the act of 1909 the duty on woven wire fencing or poultry netting ranged from 2 cents to 2¾ cents per pound, with $\frac{3}{10}$ cent per pound in addition if galvanized, with the proviso that the duty should not be less than 40 per cent ad valorem and 1 cent per pound.

By the act of 1913 galvanized wire fencing composed of wire not larger than $\frac{3}{100}$ inch in diameter nor smaller than $\frac{8}{100}$ inch was placed upon the free list. Poultry netting is not covered by this clause, being composed of wire smaller than $\frac{8}{100}$ inch in diameter. It is embraced by the basket clause in paragraph 114 among "articles manufactured * * * of wire" at 15 per cent ad valorem.

Since import statistics for these commodities are lacking except for woven wire fencing under the act of 1913 no analysis of the comparative effect on imports of the various tariff acts is possible. Imports of woven fencing although admitted free since 1914 have been very small, but this is in part at least to be attributed to the European war.

COMPETITIVE CONDITIONS.

In the manufacture of woven wire fencing and poultry netting American manufacturers have distinct advantages in an abundant and relatively cheap domestic supply of the chief raw materials—iron and steel wire and zinc for galvanizing—and an industry well organized for large scale production. Germany and the United Kingdom before the war were heavy producers. Germany, like the United States, had had an abundant domestic supply of raw materials, but the United Kingdom before the war imported both wire and zinc for wire netting. France, when she is able to develop her new iron resources, may become one of the leading producers of wire fencing and poultry netting. However, her fuel problem must first be solved.

Since the beginning of 1919 it is said British and French manufacturers have been underselling American producers of wire netting in South America.[1]

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[1] Statement in letter from Buffalo Wire Works Co. to Mr. F. D. Mitchell, secretary-treasurer, American Hardware Manufacturers' Association.

[2] Specified as "wire fence." Product of establishments making both wire fence and wire cloth and wire rope not included.

Woven wire fence and poultry netting produced in the United States.

[From Federal Census.]

	Quantity.		Value.	
	1909	1914	1909	1914
wire fencing, made by establishments d primarily in this industry	*Short tons.*	*Short tons.*	$11,695,811	$13,032,343
rire fencing made by manufacturers of wirework, agricultural implements, and ral ironwork				496,363
vire fence and poultry netting, made in partments of rolling mills	[1] 311,038	283,081	[1] 15,945,393	13,032,343
vire fence and poultry netting, made in ills	[1] 115,889	128,379	[1] 6,724,077	6,763,469
tal			[1] 34,365,281	33,324,518

ies other woven-wire products.

wire fencing and poultry netting—Approximate production of wire netting before the war [1]—Production in principal foreign countries.

Country.	Quantity.	Value.
tain	*Tons.* 35,000	$3,400,000

nd Coal Trade Review (London), June 14, 1918, p. 668.

ed wire fencing composed of wire not larger than twenty one-hundredths of an inch, naller than eight one-hundredths of an inch in diameter [1]—Imports for consump- -Revenue.

year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
	Free	32,710	$736		$0.023	
	do	282,294	8,315		.029	
	do	298,745	9,136		.031	
	do	36,150	1,002		.028	
	do	72,197	3,585		.050	
	do	3,210	368		.115	
	do	136,637	6,454		.047	

eparately specified before 1914.

Woven wire fencing[1]*—Domestic exports.*

FISCAL YEARS.

Exported to—	1913	1914	1915	Exported to—	1913	1914
France	$427	$4,838	$364	Dutch East Indies	18,187	$5,901
England	12,763	25,958	16,882	Australia	7,605	2,690
Canada	114,395	93,370	112,226	New Zealand	7,950	14,416
Mexico	15,363	12,089	9,474	British South Africa	11,854	2,235
Cuba	19,976	27,410	38,576	All other	86,706	101,209
Argentina	41,491	53,057	11,444			
Chile	8,551	5,634	518	Total	355,836	354,841
British India	10,568	6,464	22,581			

Exported to—	1916	1917	1918	Exported to—	1916	1917
France	$19,256	$843,778	$98,910	Dutch East Indies	$7,527	$22,763
England	45,661	21,026	16,488	Australia	37,541	67,046
Canada	117,340	162,654	124,051	New Zealand	12,902	23,414
Mexico	11,699	12,204	19,826	British South Africa	29,510	22,708
Cuba	98,099	102,111	162,539	All other	144,823	155,424
Argentina	52,424	51,781	22,288			
Chile	43,296	17,314	46,880	Total	648,880	1,575,137
British India	29,102	42,919	36,665			

[1] Included in "All other manufactures of iron and steel prior to 1913."

CALENDAR YEARS.

Exported to—	1918	1919	Exported to—	1918
France	$355,046	$102,157	Dutch East Indies	$11,031
Canada	123,930	116,464	Australia	85,277
Mexico	26,469	47,608	New Zealand	53,486
Cuba	159,535	287,624	Philippines	12,041
Argentina	53,355	31,701	British South Africa	13,709
Chile	29,297	14,566	All other	86,121
Kwantung		27,667		
British India	27,433	13,498	Total	1,036,739

Galvanized wire fencing and poultry netting [1]*—Rates of duty.*

—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
	182	Iron or steel wire, smaller than No. 5 and not smaller than No. 10 wire gauge.	1¼ cents per pound.
		Smaller than No. 10 and not smaller than No. 16 wire gauge..	2 cents per pound.
		Smaller than No. 16 and not smaller than No. 26 wire gauge..	2½ cents per pound.
		Smaller than No. 26-wire gauge	3 cents per pound.
		* * * *And provided further*, * * * That iron or steel wire nettings, made in meshes of any form shall pay a duty equal in amount to that imposed on iron or steel wire of the same guage, and 2 cents per pound in addition thereto. There shall be paid on galvanized iron or steel wire (except fence wire) one-half of 1 cent per pound in addition to the rate imposed on the wire of which it is made. * * *	2 cents per pound in addition.
	148	Wire made of iron or steel, not smaller than No. 10 wire gauge.....	1¼ cents per pound.
		Smaller than No. 10 and not smaller than No. 16 wire gauge..	1½ cents per pound.
		Smaller than No. 16 and not smaller than No. 26 wire gauge..	2½ cents per pound.
		Smaller than No. 26-wire gauge	3 cents per pound.
		* * * *And provided further*, * * * That iron or steel wire nettings, made in meshes of any form, shall pay a duty equal in amount to that imposed on iron or steel wire used in the manufacture of iron or steel wire cloth, or iron or steel wire nettings, and 2 cents per pound in addition thereto.	2 cents per pound in addition.
	124	Wire: Round iron or steel wire, all sizes not smaller than No. 13 wire gauge.	1½ cents per pound.
		Smaller than 13 wire gauge, and not smaller than 16 wire gauge.	1¾ cents per pound.
		Smaller than 16 wire gauge	2 cents per pound.
		* * * all the foregoing manufactures of iron or steel * * * valued above 4 cents per pound, shall pay a duty of 40 per cent ad valorem.	
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
7	137	Round iron or steel wire, not smaller than No. 13 wire gauge.....	1¼ cents per pound.
		Smaller than No. 13 and not smaller than No. 16 wire gauge..	1½ cents per pound.
		Smaller than No. 16 wire gauge	2 cents per pound.
		Provided, That all the foregoing valued at more than 4 cents per pound shall pay 40 per centum ad valorem * * *	
		Provided, That articles manufactured from iron, steel * * * wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1½ cents per pound * * *	
		* * * and on iron or steel wire coated with zinc, tin, or any other metal, two-tenths of 1 cent per pound in addition to the rate imposed on the wire from which it is made.	
	135	Round iron or steel wire, not smaller than No. 13 wire gauge..	1 cent per pound.
		Smaller than No. 13 and not smaller than No. 16 wire gauge..	1¼ cents per pound.
		Smaller than No. 16 wire gauge	1¾ cents per pound.
		Provided, That all the foregoing shall pay duty at not less than 35 per cent ad valorem.	
		* * * on iron or steel wire coated by dipping, galvanizing, or similar process with zinc, tin, or other metal, there shall be paid two-tenths of 1 cent per pound in addition to the rate imposed on the wire of which it is made.	
		Provided further, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles, and in addition thereto 1 cent per pound.	
		And provided further, That no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem.	
	645	* * * galvanized wire fencing composed of **wires** not larger than twenty one-hundredths of 1 inch in diameter nor smaller than eight one-hundredths of 1 inch in diameter, * * *	Free.
	114	* * * articles manufactured wholly or in chief value of any wire or wires provided for in this section; all the foregoing 15 per cent ad valorem; * * *	15 per cent ad valorem.

[1] clauses referring to wire smaller than No. 16 wire gauge apply to poultry netting, also the clause from par. 114, 1913.

PINS.

SUMMARY.

The value of common or toilet pins, hairpins, and safety pins produced in the United States in 1914 was $2,713,782, of which common or toilet pins represented 46 per cent, metal hairpins, 19.5 per cent, and safety pins, 34.5 per cent. Connecticut is the leading producing State.

Common pins, hairpins, and safety pins are made by automatic machines, the chief raw materials being wire of brass or iron. In the cost of the raw material American producers are at no disadvantage, but wages are somewhat higher than the wages paid by their European competitors.

Imports of pins have been persistent, but not large in proportion to domestic production. In 1914 the value of imports amounted to $235,571 or to 8.7 per cent of the value of domestic production. Before the war some pins were exported, but England and Germany held most of the export trade. After 1915 there was a better foreign demand for American pins.

The leading foreign producers are England, Germany, and France.

The duty on pins is 20 per cent ad valorem. Against such a flat rate manufacturers protested in the tariff hearings of 1913. They contended that foreign producers had an advantage in lower labor costs, and that the advantage was relatively greater in the case of pins of iron than in the case of pins of brass, since labor costs represented a greater part of total costs in the former case than in the latter. They desired, therefore, a higher rate for iron pins than for brass pins.

Pins—Summary table.

Year.	Domestic production.[1]	Value (imports for consumption.)[2]	Amount of duty.[2]	Actual or equivalent ad valorem rate.[2]
				Per cent.
1910		$240,528	$84,185	35.00
1911		245,412	85,894	35.00
1912		193,198	67,619	35.00
1913		178,399	62,176	34.85
1914	$2,713,782	235,571	53,014	22.50
1915		178,046	35,609	20.00
1916		137,235	27,447	20.00
1917		110,028	22,006	20.00
1918		105,329	21,066	20.00
1919		97,057	19,411	20.00

[1] Census year. [2] Fiscal years ending June 30.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

PAR. 158. Pins with solid heads, without ornamentation, including hair, safety, hat, bonnet, and shawl pins; any of the foregoing composed wholly of brass, copper, iron, steel, or other base metal, not plated with gold or silver, and not commonly known as jewelry, 20 per centum ad valorem.

DESCRIPTION.

The paragraph above enumerates the kinds of pins included in this rvey. The uses of these are so well known that they need not be entioned here.

DOMESTIC PRODUCTION.

Raw materials.—The chief raw materials are iron wire and brass re. Other items enumerated as raw materials by manufacturers e sheet steel, sheet brass, brass rods, nickel, tin crystals (chloride, $SnCl_4$), other chemicals, cardboard, and pin paper. Before the war l the raw materials required except some chemicals and special azed paper were obtained from domestic sources of supply. After e outbreak of the war American substitutes were found for the iported chemicals.

Equipment.—Equipment consists primarily of automatic pin-aking and pin-sticking machines. These are made in the United tates and were invented in this country. It is asserted by the anufacturers that the English and Germans have machines just as fficient as the American and that some machines used in American ctories are duplicates of the foreign machines.

Method of production.—The modern pin-making machine com-letes the pin in all respects except coloring and polishing. The pin formed from wire; iron wire for the cheapest pins, hardened ucible steel for the best, and brass for the great majority. A reel wire as it comes from the wire drawer is placed in the rear of the achine, and the end of the wire is grasped by a pair of nippers ich pull it over a straightening board and pass it on completely raightened until it is seized by two cheeks, when a cutter descends d cuts it off, leaving the projecting part for the head. On the thdrawal of the cutter a hammer flies forward and makes the head, e cheeks open, and the pins drop upon a sloping metal plate, finely oved, down which they slip with heads upward, until the end ich is to be pointed comes in contact with a cylindrical roller with rinding surface which grinds points on the pins by the operation two or three ingenious arrangements. The various operations performed so rapidly that they can scarcely be perceived by the e and the pins fall into a box at a rate of from 200 to 400 per nute. They are then washed in hot water and potash or soda or mbled in sawdust, washed again, tinned, and prepared for papering. Pins are attached to papers by pin-sticking machines, each worked two operatives. By ingenious arrangements the pins, upon being l into this machine, are arranged in rows and passed down a set of oves until they reach the paper. The paper is pinched into ular folds and pierced to receive the pins, which come exactly their places and are pressed into the holes.

The same general process is followed in the making of safety pins, ly here the process is more complex, since not only must the wire cut and pointed, but it must be bent to the desired shape, and in rtain styles of pins a sheath or catch must be attached. The achines are entirely automatic in their action and require but little tention.

Organization.—The pin industry is a relatively small one. The nerican Pin Co. in 1913 estimated the capital invested in the

industry at $1,250,000, basing its estimates upon the number of machines believed to be in operation. At that time nine companies were engaged in making pins, some, or all of which were producing also other articles, such as hooks and eyes, needles, and snap fasteners. The Census of 1914 reported 49 establishments engaged in the production of needles, pins, and hooks and eyes. Of these, 10 manufactured common or toilet pins; 7, metal hairpins; and 3, safety pins. The output of all varieties of pins in 1914 was valued at $2,713,782, of which common or toilet pins formed 46 per cent; metal hairpins, 19.5 per cent; and safety pins 34.5 per cent.

Geographical distribution.—Connecticut reported $990,169, or 79.2 per cent, of the total value of common or toilet pins manufactured in the United States in 1914; and $321,605, or 60.9 per cent, of the hairpins. Connecticut was also the leading State in the production of safety pins.

History of the industry.—The invention of the process of drawing wire was the foundation of modern pin manufacture, and for years the industry was confined to two countries, France and Germany, where this process was invented. Brass wire pins were first made in England in 1826. The industry spread rapidly and in 10 years it was well established at Gloucestershire, Bristol, Birmingham, and London.

At first pins were made by filing a proper length of wire to a point and then twisting a piece of fine wire around the other extremity, the complete process requiring 13 or 14 operations, most of them performed by hand labor. In 1797 a solid-headed pin was made by an improved process by Timothy Harris of England.

The most important improvement in pin making was the machine invented by Lemuel Wright, of the United States, in 1824, by which solid heads were made by automatic action. In 1831 a machine for making perfect solid-headed pins was invented by John Ireland Howe of New York City. The next year a company was organized to make pins after his patent and six years later established a plant at Derby, Conn.

In 1838 Samuel Slocum, of Connecticut, began making pins, using a machine he had invented but not patented in the United States. In 1841 there was introduced into Howe's factory at Derby, Conn., a pin-sticking machine invented by Slocum.

Domestic production and consumption.—The value of common or toilet pins produced in the United States in 1899 was $465,605; in 1904, $1,129,006; and in 1914, $1,248,757. The value of hairpins produced in 1899 was $78,155; in 1904, $109,245; and in 1914, $528,362. The value of safety pins produced in 1899 was $354,294; in 1904, $829,386; and in 1914, $936,663. The total value of all varieties of pins produced in 1914 was $2,713,782.

Imports of pins have been persistent. In 1899 the value of imports amounted to 13 per cent of the value of domestic production, and in 1914 to 8.7 per cent. No official statistics of exports are available, but reports from manufacturers indicate that exports were very small before the war. After 1915 there was an active foreign demand for American pins, but domestic producers did not push the foreign trade, having difficulty in supplying the home market. Prior to the war consumption was apparently greater than domestic production, but since 1917, there has been a small exportable surplus.

stic exports.—Before the war American manufacturers pro- some pins for export, but England and Germany held most of ort trade. After 1915 there was a better foreign market for an pins, but American producers had difficulty in supplying nestic demand and made little effort to develop the foreign

FOREIGN PRODUCTION.

re the war England, Germany, and France were the leading producers. Germany exported many low-grade pins cheaply . But England exported some high-grade pins handsomely which competed in our market with the domestic product. he pressure of German and English competition removed the se pin industry was given an opportunity to expand, but the uality of the Japanese product interfered with its ready sale in rld market.

IMPORTS.

orts of pins have been persistent. During the 16 years, 1898 3, inclusive, the annual imports ranged from a minimum of 0 in 1899 to a maximum of $245,412 in 1911. In 1914 imports alued at $235,571. Thereafter they declined steadily until in ey were valued at only $97,057.[1] Since the price of pins in- during that period the decline in the quantity of imports was relatively than the decline in value. Imports have been from England and Germany.

PRICES.

lata are available making possible comparison between domes- recent foreign prices.

TARIFF HISTORY.

er the tariff acts of 1883 and 1890 pins were dutiable at 30 per l valorem; in the act of 1894 the duty was reduced to 25 per n the acts of 1897 and 1909 it was fixed at 35 per cent; and in of 1913 it was reduced to 20 per cent. Imports were persistent nder the highest duty imposed by these various acts. Imports fiscal year 1914, during the last nine months of which the lower 20 per cent was in operation, were 32 per cent greater in value the preceding year, but they were smaller than in 1910 or 1911 he 35 per cent duty was in effect. After 1914 imports declined r, doubtless because of the war.

COMPETITIVE CONDITIONS.

he manufacture of pins American producers are at no disad- e as regards the chief raw materials—wire of brass and iron. other hand, wages are higher in the United States than in d, Germany, and France. But in the pin industry as in other ies labor costs per unit of product do not vary in direct propor-

[1] One-half of these imports were derived from Birmingham, England.

tion with wages, since the efficiency of labor, equipment, and m
ment enter as factors.

Although pins are made by automatic machinery there is co
able labor involved, since there are various operations which c
be performed by machinery. In 1913 the American Pin Co.
lated that of the total amount it paid out in direct labor cos
raw material costs in the manufacture of brass pins, labor costs
sented 18 per cent and raw material costs represented 82 pe
For iron pins the direct labor cost was 40 per cent and the m
cost was 60 per cent. The relatively higher raw material co
brass pins as compared with iron pins still persist.

TARIFF CONSIDERATION.

In the brief of the American Pin Co. submitted to the Com
on Ways and Means in 1913 it was asserted that a uniform ad v
duty covering all classes of pins is unsatisfactory. It was cont
that iron pins required a higher ad valorem rate of duty than
pins because labor costs represented a larger part of the total
It was assumed that the cost of raw material was the same in E
and the United States. It was asserted that the labor costs we
same per pound for pins of iron or pins of brass, and that a s
duty on a pack of 4,320 pins, by giving to the cheaper iron
higher protection than it gave to brass pins was preferable to a
ad valorem rate on both kinds.

Production of pins in the United States.

[From Federal Census.]

Kinds.	1899		1904		191
	Quantity.	Value.	Quantity.	Value.	Quantity.
	Gross.		*Gross.*		*Gross.*
Toilet or common pins	47,338,429	$465,605	132,632,232	$1,129,006	(1)
Hairpins of metal	1,189,104	78,155	1,704,900	109,245	9,242,012
Safety pins	1,640,284	354,294	2,550,650	829,386	4,744,503
Total	50,167,817	898,054	136,887,782	2,067,637	

[1] The quantity of toilet pins in 1914 is reported in pounds and packs of 3,360 and 3,600. In 19
pounds and 1,825,673 packs of pins made of steel wire were produced, valued at $346,697; and
pounds and 1,638,035 packs of pins made of brass wire, valued at $902,265.

ins, with solid heads, without ornamentation, composed wholly of brass, copper, iron, steel, or other base metal, not plated with gold or silver, and not commonly known as jewelry—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
	35 per cent		$155,709	$54,529		35.00
	do		151,779	53,123		35.00
	do		174,108	60,938		35.00
	do		240,528	84,185		35.00
	do		245,412	85,894		35.00
	do		193,198	67,619		35.00
	35 per cent		177,645	62,176		35.00
	Duty remitted, sec. 23.		754			
	35 per cent		40,366	14,128		35.00
	20 per cent		194,428	38,886		20.00
	Free, Secs. N, M		777			
	20 per cent		178,046	35,609		20.00
	do		137,235	27,447		20.00
	do		110,028	22,006		20.00
	do		105,329	21,066		20.00
	do		97,057	19,411		20.00

July 1 to Oct. 3, 1913, under act of 1909.
Oct. 4, 1913, to June 30, 1914, under act of 1913.
For manufacture in bonded warehouse and export.

Court and Treasury Decisions.

Because prior tariff acts treated hairpins as distinct from "pins, lid-head or other," hairpins of iron or steel wire were held dutiable manufactures of metal under the act of 1883. (Robertson *v.* osenthal, 132 U. S., 460.) But mourning, hat, bonnet, and shawl ins of steel or hardened iron shanks and having round or cut heads glass or jet, and safety pins of brass were held to come within the rovision for "pins, solid head and other" under paragraph 209 of ie act of 1883 (Dieckerhoff *v.* Robertson, 44 Fed., 160). The pins rst named were held to come within paragraph 206 of the act of 1890 nd paragraph 170 of the act of 1894 as "pins, metallic, solid head nd other," whether having fancy heads or otherwise (Worthington *v.* Inited States, 90 Fed., 797; G. A. 3239, T. D. 16521). The word metallic" was interpreted to qualify the whole paragraph and to xclude from the paragraph pins that were not metallic (Claflin o. *v.* United States, 78 Fed., 805.)

Black-headed pins were held dutiable under paragraph 206 of the ct of 1890 as "pins, metallic," and not under paragraph 108 as lass manufactures. (Steinhardt *v.* United States, 92 Fed., 139.) The dividing line between pins that are and pins that are not lassable as jewelry has been the subject of much controversy. ins completely made of precious metals or in imitation thereof and ttached to the attire because of their ornamental character rather an because of their utility have been declared to be jewelry within ie common understanding of the term. (United States *v.* Flory, Ct. Cust. Appls., 87, 89; United States *v.* Strauss, 4 Ct. Cust. Appls., 86, and cases cited in the two opinions.) These case concerned incipally gold-plated hat pins imported under the act of 1909. the Flory case the court said:

> The goods are fully gold plated and are therefore made in imitation of one of the ecious metals. They are complete in themselves and have an individuality of their n which distinguish them from the attire or wearing apparel to which they may be

attached. They are valuable to the consumer rather because of their ornamental character than by reason of their utility, and are clearly designed to be used as articles of personal adornment. In fact, except that they are somewhat smaller, there is nothing to distinguish the so-called lace pins from scarfpins or stick pins, and there is nothing about them which would lead the casual observer to believe that they are anything other than what they seem to be, namely, articles of gold designed to be worn on the apparel as an ornament. Whatever else may be so regarded, merchandise of such a nature, in our opinion, comes within the common understanding of jewelry and is covered by the last clause of paragraph 448.

In a later case lace and shawl pins with gold plated steel shafts and paste heads some colors and some white in imitation of small pearls, all valued at less than 20 cents per dozen pieces, were held to be dutiable as manufactures in chief value of metal and not as jewery under the act of 1909. The Flory case was declared not to "overrule in any way the case to which it referred which had dealt with pins designed not for use distinctively as articles of adornment, but rather to meet the necessity of meeting special conditions which required that they should serve a utilitary purpose without being unduly conspicuous." (Altman *v*, United States, 5 Ct. Cust. Appls., 296.)

In a case under the act of 1913 the decisions are again reviewed and the popular conception of jewelry was declared necessarily to imply an article of personal adornment, but not to imply that all articles of personal adornment are jewelry and hatpins and hairpins composed of metal and paste, paste of chief value, were held dutiable as manufactures in chief value of paste under paragraph 95 rather than as jewelry under paragraph 356 of the act of 1913. (Bloomingdale *v*. United States, 8 Ct. Cust. Appls., 314.)

Hairpins and safety pins overlaid and coated with precious or base metals have been held to be plated. (Bloomingdale *v*. United State 3 Ct. Cust. Appls., 204, under the act of 1897.) The fact that pins answering to the description in paragraph 158 of the act of 1913 are coated with lacquer does not withdraw them from the operation of the words "composed wholly of" the metals named in the paragraph and make them dutiable as manufactures of wire under paragraph 114. (Hague *v*. United States, 7 Ct. Cust Appls., 75.)

Hairpins in cabinets were held separately dutiable from the boxes under the act of 1897. (Abstract 25702, T. D. 31624.)

See survey upon jewelry.

Pins—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883	209	Pins, solid head or other	30 per cent ad valorem.
1890	206	Pins, metallic, solid head or other, including hairpins, safety pins, and hat, bonnet, shawl, and belt pins.	Do.
1894	170	Pins, metallic, including pins with solid or glass heads, hair pins, safety pins, and hat, bonnet, shawl, and belt pins, not commercially known as jewelry.	25 per cent ad valorem.
1897	188	Pins with solid heads, without ornamentation, including hair, safety, hat, bonnet, and shawl pins; any of the foregoing composed wholly of brass, copper, iron, steel, or other base metal, not plated, and not commonly known as jewelry.	35 per cent ad valorem.
1909	188	Pins with solid heads, without ornamentation, including hair, safety, hat, bonnet, and shawl pins; any of the foregoing composed wholly of brass, copper, iron, steel, or other base metal, not plated with gold or silver, and not commonly known as jewelry.	Do.
1913	128	Pins with solid heads, without ornamentation, including hair, safety, hat, bonnet, and shawl pins; any of the foregoing composed wholly of brass, copper, iron, steel, or other base metal, not plated with gold or silver, and not commonly known as jewelry.	20 per cent ad valorem.

WIRE HEDDLES OR HEALDS.

SUMMARY.

heddles are used in looms and are essential to the efficient
n of the textile industries.
American style heddle made of strands of twisted iron wire
d prior to 1889 or 1890, when the German style heddle, the
e heddle, made of two strands of tempered steel wire tinned
red together, largely displaced the American. Manufacture
erman style began in this country in 1902, and the industry
eloped under protection. Imports decreased gradually from
00 heddles in 1910 to 16,214,000 in 1918. In the last half of
ndar year 1919, however, imports increased to 21,068,000

rincipal foreign producers before the war were Germany and
During the six months, July–December, 1919, imports
olly from France and Switzerland.
ction is by automatic machinery and the cost of raw material
r than labor cost, an advantageous circumstance for Ameri-
lucers. It was estimated in 1912 that domestic production
d to about three-fourths of domestic consumption.
dustry is located in Massachusetts, Rhode Island, Pennsyl-
ew York, and New Jersey.

Wire heddles or healds—Summary table.

ear.	Domestic production.	Imports for consumption.[1]	Ratio of imports to production.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity (per 1,000).	Actual or equivalent ad valorem rate.
	Thousands.	*Thousands.*	*Per cent.*				*Per cent.*
		88,030		$48,523	$41,417	$0.551	85.35
		66,888		44,332	34,455	.663	77.72
	[2] 190,000	61,718	32.00	44,519	33,237	.721	74.66
		60,963		38,812	30,766	.637	79.26
		65,701		52,723	16,366	.803	31.04
		51,876		40,261	10,065	.776	25.00
		50,307		44,059	11,015	.876	25.00
		19,432		22,518	5,630	1.158	25.00
		16,214		20,683	5,171	1.275	25.00
	[3] 150,000	17,761	11.80	30,522	7,631	1.719	25.00

rs ending June 30.
of Samuel V. S. Muzzy in hearings and statements before the Committee on Finance of the
s Senate, 1912, p. 418. His estimate was in round numbers, 250,000,000 for imports and pro-
bined.
of H. C. Coley, treasurer Howard Bros. Manufacturing Co., Worcester, Mass.

GENERAL INFORMATION.

TARIFF PARAGRAPHS, ACT OF 1913.

14.—* * * wire heddles and healds, 25 per cent ad
* * * *.

DESCRIPTION.

In weaving, the threads of the warp are so arranged that at each passage of the shuttle backward and forward a certain number of the warp threads are raised and the remainder lowered. This is done by vertical threads, cords, or wires with a small loop in the middle through which the warp thread is passed, there being one vertical thread or wire for each horizontal or warp thread. These threads or wires are known as heddles or healds. It is estimated that about one-third of the looms in this country are equipped with wire heddles.

In the United States there are, roughly speaking, three classes of wire heddles manufactured:

1. The iron wire, or so-called domestic heddle, made of soft iron wire.
2. The twin wire, or double strand, heddle, made of cast steel tinned wire, with soldered eyes.
3. The so-called flat steel heddle, made of strip or flat wire, with punched eyes.

These three styles are used on a great variety of weaving and each particular style has its particular advantage for given classes of fabrics. Along with wire heddles should be considered also wire false reeds used in the back of looms. A wire false reed consists of a single strand of wire about 5 inches long with a loop at either end but no eye in the center. The warp threads on a loom pass between the false reeds, not through an eye in them as in the case of heddles.

In silk mills, where fine light heddles are required, cotton heddles are preferred by some workers who can not use wire heddles successfully. In the silk mills of at least one large producer in the United States French wire heddles are considered superior to all others. They are preferred to American, German, and Belgian heddles because of their greater smoothness and fineness. The advantages of French wire heddles over cotton heddles are:

1. Greater durability.
2. They can be used over and over, whereas the cotton heddles must be discarded after being used once.
3. Wire heddle frames can be widened; cotton heddle frames can not be widened.

During the war the silk producer referred to above, not being able to get French heddles, used American flat steel heddles instead. This flat steel heddle did not prove satisfactory in all cases. It was used successfully on schappe and good raw silk, and on good quality soft dyed silk. But being heavier than the French wire heddle it causes the silk threads to break when the quality of the silk is poor. The cotton heddles used by this silk manufacturer are made in his own mills of cotton yarn imported from Switzerland.

DOMESTIC PRODUCTION.

No satisfactory production statistics are available. The census does not specify production of heddles, and there is no association in the industry itself from which statistics might be obtained. One American producer estimates production at about 150,000,000 heddles yearly, but asserts it is utterly impossible to estimate the

e of the output. The importance of the industry arises not
its size but from the fact that any interruption in the supply
eddles would vitally affect the textile industry.

laterials.—Requisite materials are iron or steel wire and solder.

lethods of production.—Wire heddles are made by automatic
hines which do not require constant attention. Each machine
turn out 12,000 to 14,000 heddles a day. In a shop with a
ber of machines most of them can be attended by boys or girls,
being required only as foremen or as mechanics to keep the
hines in order. The best plants in Europe are as well equipped
organized as those in the United States.

rganization.—The demand for heddles is limited and plants on
ry large scale are not required. A plant containing nine machines
estimated in 1912 to cost about $10,000. Employing three
and six boys, such a plant would produce 30,000,000 heddles a
r against an estimated consumption in the United States in 1912
50,000,000 heddles.

eographical distribution.—Thomas's Register of American Manu-
urers lists 26 firms under the subject of heddles, but some of
n are merely importers. They are all located in Massachusetts,
de Island, Pennsylvania, New York, and New Jersey. The
stry naturally grows up in textile manufacturing districts.

istory of the industry.—The American style heddle, made of
nds of twisted iron wire, was used prior to 1889 or 1890. At
t date the German style heddle, the twin wire heddle, made of
strands of tempered steel wire tinned or soldered together, largely
laced the American. Importation began in 1889. Manufacture
he German style in this country began in 1902, and in 1903
was produced commercially. The industry has developed under
tection since 1903. Imports were much reduced under the act of
9.

omestic production and consumption.—Domestic consumption was
mated in 1912 at 250,000,000, valued at less than $500,000. In
t year imports were 61,718,500, valued at $44,519. If the esti-
te of consumption is approximately correct domestic production
plied about three-fourths of the demand. In April, 1920, an
erican manufacturer estimated domestic production at approxi-
tely 150,000,000 heddles yearly, but he would not venture to
mate the value of this production. A certain type of heddle
le of cotton and used in silk mills could not in 1912 be manu-
ured in this country, being monopolized by French manufac-
rs who had control of the automatic machines producing it.
se machines could not be imported. Some silk manufacturers,
ever, prefer the wire heddle.

omestic exports.—No domestic exports are specified. Some ex-
t trade developed during the war.

FOREIGN PRODUCTION.

he principal foreign producers before the war were Germany and
nce. Wire heddles are also made in Switzerland, England and
gium. Importers in 1912 testified that the German made heddle
superior to any other.

Silk manufacturers express a decided preference for the French wire heddle because of its lightness and smoothness. The French wire heddle machine is patented and can not be imported. French heddle manufacturers, it is said by an American silk producer, make their own wire designed particularly for the production of heddles.

An American heddle manufacturer recently stated (Apr. 28, 1920) that the most severe competition in the future will come from Germany.

IMPORTS.

Prior to 1910 imports were not specified. From 1910 to 1918 imports steadily decreased in quantity except for a slight increase in 1914 over 1913. In 1910 imports were 88,030,000 heddles, valued at $48,523. In 1918 imports were only 16,214,000, valued at $20,683. In the fiscal year 1919 there was a small increase in quantity and 50 per cent increase in value over the fiscal year 1918. During the first half of the fiscal year 1920 imports were greater than in either 1918 or 1919, amounting for the six month period to 21,068,000 heddles, valued at $50,200.

An examination of the customhouse records of New York showed that of the $50,200 worth of heddles imported during the six months ending December 31, 1919, $47,623 worth entered through the port of New York, of which $27,649 came from France and $19,974 from Switzerland.

PRICES.

In September, 1919, flat steel heddles were imported from Switzerland at 13.25 francs per 1,000. At the rate of Swiss exchange on August 30, 1919, this was equal to $2.52 per 1,000. In the same month steel heddles were imported from France at 20.40 francs per 1,000. At the rate of French exchange on August 30, 1919, this was exactly equal to the price of the Swiss heddles, $2.52 per 1,000.

The average value per 1,000 of all heddles imported during the three months, October–December, 1919, as shown in the quarterly statement of imported merchandise entered for consumption in the United States, was $2.62. This does not represent actual values, however, since part of the imports were valued with exchange at par.

TARIFF HISTORY.

Under the act of 1894 wire heddles were dutiable as manufactures of wire at 3 cents per pound, or if made of wire valued at more than 4 cents per pound at 1 cent per pound and 40 per cent ad valorem on the wire of which they were composed.

Under the act of 1897 the duty was 3¼ cents per pound, or if the heddles were made of wire valued at more than 4 cents per pound 1¼ cents per pound and 40 per cent ad valorem on the wire of which they were composed, with two-tenths of 1 cent per pound in addition if made of galvanized wire.

By the act of 1909 wire heddles were made dutiable at 25 cents per thousand and 40 per cent ad valorem, a higher rate of duty than prevailed before.

In 1913 the duty was sharply reduced to 25 per cent ad valorem.

Import statistics are available only since 1910. It has been stated by importers that imports were greatly reduced by the increase in the rate in 1909. The reduction in duty in 1913 brought no increase, however, but was followed by a further decrease in imports.

COMPETITIVE CONDITIONS.

Before the war American manufacturers had the advantage of cheaper wire, but paid much higher wages than their European competitors. The best plants in Germany and France were as well equipped and organized as our own. Importers admitted that cost of production was lower in Europe than here.

Cost analysis presented by an American manufacturer for the tariff hearings in 1913 shows that in manufacturing 12-inch wire heddles of No. 28 wire the raw material costs were 51 cents per thousand as against labor costs, including superintendence and inspection of 37 cents; on the larger size heddles, 14 inches long, made of No. 24 wire, raw material costs were $1.02 per thousand as against 37 cents for labor, including superintendence and inspection.

In April, 1920, a heddle manufacturer estimated the proportion of labor and raw material costs as follows: Labor, 35 per cent; raw material, 65 per cent.

Labor costs comprise a relatively small proportion of total costs, because wire heddles are made by automatic machinery. This reduces the advantage derived by European producers from their lower wage scales. In the case of heddles made of wire regularly produced in large quantities in the United States, American heddle manufacturers enjoy an advantage over European producers in lower costs of raw material. Statistics are not available showing what proportion of wire heddles is made from such wire.

Wire heddles or healds—Production in United States.

[From estimate in tariff hearing.][1]

Number, 1912, 190,000,000; 1919, 150,000,000.[2]

Heddles, or healds wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Thousands.				*Per cent.*
1910	25 cents per thousand plus 40 per cent.	88,030	$48,523	$41,417	$0.551	85.35
1911	do	66,888	44,332	34,455	.663	77.72
1912	do	61,719	44,519	33,237	.721	74.66
1913	do	60,963	38,812	30,766	.637	79.26
1914	do	8,347	7,325	5,017	.878	68.49
	25 per cent	57,355	45,398	11,350	.792	25.00
1915	do	51,876	40,261	10,065	.776	25.00
1916	do	50,307	44,059	11,015	.876	25.00
1917	do	19,432	22,518	5,630	1.158	25.00
1918	do	16,214	20,683	5,171	1.275	25.00
1919	do	17,761	30,522	7,631	1.719	25.00

[1] See footnote [2] on p. 163.

[2] Not separately stated prior to 1910.

Wire heddles or healds—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883....	182	Iron or steel wire, smaller than No. 5 and not smaller than No. 10 wire gauge.	1½ cents per pound.
		Smaller than No. 10, and not smaller than No. 16 wire gauge.	2 cents per pound.
		Smaller than No. 16, and not smaller than No. 26 wire gauge.	2½ cents per pound.
		Smaller than No. 26 wire gauge.....	3 cents per pound.
		* * * *And provided further*, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made either wholly or in part.	
		* * * There shall be paid on galvanized iron or steel wire (except fence wire) one-half of 1 cent per pound in addition to the rate imposed on the wire of which it is made.	
1890....	148	Wire made of iron or steel, not smaller than No. 10 wire gauge.	1½ cents per pound.
		Smaller than No. 10, and not smaller than No. 16 wire gauge.	1¾ cents per pound.
		Smaller than No. 16 and not smaller than No. 26 wire gauge.	2½ cents per pound.
		Smaller than No. 26 wire gauge.....	3 cents per pound.
		* * * *And provided further*, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made either wholly or in part.	
		* * * There shall be paid on iron or steel wire coated with zinc or tin, or any other metal (except fence wire and iron or steel, flat, with longitudinal ribs, for the manufacture of fencing), one-half of 1 cent per pound in addition to the rate imposed on the wire of which it is made.	
		* * * *Provided further*, That all iron or steel wire valued at more than 4 cents per pound shall pay a duty of not less than 45 per cent ad valorem, * * *.	
1894....	124	Round iron or steel wire, all sizes not smaller than 13 wire gauge.	1½ cents per pound.
		Smaller than 13 wire gauge, and not smaller than 16 wire gauge.	1¾ cents per pound.
		Smaller than 16 wire gauge.....	2 cents per pound.
		* * * all the foregoing manufactures of iron and steel * * * valued above 4 cents per pound, shall pay a duty of 40 per cent ad valorem.	
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound.	
1897....	137	Round iron or steel wire, not smaller than No. 13 wire gauge....	1½ cents per pound.
		Smaller than No. 13 and not smaller than No. 16 wire gauge..	1¾ cents per pound.
		Smaller than No. 16 wire gauge.....	2 cents per pound.
		Provided, That all the foregoing valued at more than 4 cents per pound shall pay 40 per cent ad valorem.	
		* * * *Provided*, That articles manufactured from iron, steel, * * * wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1¼ cents per pound.	
		* * * and on iron or steel wire coated with zinc, tin, or any other metal, two-tenths of 1 cent per pound in addition to the rate imposed on the wire from which it is made.	
1909....	135	* * * wire heddles or healds.....	25 cents per thousand plus 40 per cent ad valorem.
1913....	114	* * * wire heddles and healds.....	25 per cent ad valorem.

CARD CLOTHING.

SUMMARY.

card clothing industry in the United States is carried on pally by eight establishments, most of which are located in chusetts. The total annual output and amount of capital ed are not definitely known; the best information at hand indicate the amount of annual production to be somewhere en 1,300,000 and 2,800,000 square feet.

eign-made card clothing sold in the United States comes from England and Germany. In the fiscal year 1920 the ts amounted to 278,527 square feet, valued at $525,775.

re is very little, if any, difference in quality between card ng of foreign make and that made in the United States, and ently there is not any very great difference in prices of the tic and foreign articles in the United States. The imports varied only slightly from year to year over a period of at least f century. The amounts imported are influenced to some by the preference of some users of card clothing.

Card clothing—Summary table.

Fiscal year.[1]	Imports for consumption.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem. rate.
	Square feet.				*Per cent.*
	501,602	$376,119	$225,904	$0.75	60.06
	324,429	256,899	147,415	.79	57.38
	224,248	184,785	103,868	.82	56.21
	285,897	236,915	132,838	.83	56.07
	216,945	184,771	70,470	.85	38.14
	283,325	213,827	74,767	.75	34.97
	238,623	202,351	70,514	.85	34.85
	175,866	204,825	71,539	1.16	34.93
	200,035	307,343	107,128	1.54	34.86
	217,394	406,117	141,260	1.87	34.78
	278,527	525,775	183,292	1.89	34.87

years ending June 30.

-Domestic production and domestic exports figures are not available.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

. 124. Card clothing not actually and permanently fitted to tached to carding machines or to parts thereof at the time of tation, when manufactured with round iron or untempered steel wire, 10 per centum ad valorem; when manufactured empered round steel wire, or with plated wire or other than iron or steel wire, or with felt face, or wool face, or rubber loth containing wool, 35 per centum ad valorem.

DESCRIPTION.

Card clothing consists of a foundation, generally cloth, set v teeth made of round or flat bright, hardened, and tempered s wire and is used by textile mills to card or comb cotton, wool, wors silk, asbestos, and other fibers. It is also used in "nappin which is a process of raising the ends of fibers manufactured i cloth. The foundation consists usually of a woven fabric, weigh 22 ounces a square yard, made of linen warp and woolen filli which is cemented between two layers of cotton cloth, the lat usually woven from No. 28 warp yarn, 68 threads to the square in and from No. 16 filling yarn, 64 threads to the square inch.

Two other kinds of foundation are also used, namely, cott cotton-woolen-cotton, and the 4-ply natural india-rubber face clo

The cotton-cotton-woolen-cotton foundation is made by cementi one ply of cotton cloth on the linen and woolen fabric with oil cem and two plies of cotton cloth on the other side with rubber ceme This foundation costs considerably more a square foot than the cott woolen-cotton foundation and is used extensively for mak cylinders and doffers.

The 4-ply natural india-rubber face foundation is made w three plies of cotton cloth and one ply of fine linen cloth (lin warp, cotton filling), all cemented together with rubber cement a with a natural india-rubber face on the cloth. This foundation co slightly more a square foot than the cotton-woolen-cotton foun tion and is used extensively for cylinders and special clothing.

Cotton card clothing differs materially, both in foundation, fab and teeth, from that used for carding wool.

Classified according to the different kinds of wire used in c struction, the principal grades are as follows:

1. Card clothing made with round iron and bright, hardened, tempered steel wire.

2. Card clothing made with brass and bronze wire.

3. Card clothing made with convex, double convex, angu sectional, plated, and tinned wire.

There are no substitutes and competing articles.

DOMESTIC PRODUCTION.

The manufacture of card clothing is an industry in itself, exc in so far as it is made by some textile manufacturers for use in t own mills, and is carried on in the United States mainly by e concerns. Nearly all of these make clothing for wool and wor cards as well as for cotton cards. Only one concern gives its wh attention to the manufacture of cotton card clothing.

In 1913 the statement was made by manufacturers that during preceding three years 2,435,334 square feet of card clothing was m and sold in the United States,[1] making a yearly average of 1,217 square feet. This statement is attacked, however, by an impor firm which estimated the domestic output for the three-year pe at approximately 8,463,000 square feet,[2] or a yearly averag 2,821,000 square feet.

[1] Geo. L. Hamilton, representing six American manufacturers before the Ways and Means Comm H. R. Doc. No. 1447, p. 1292.

[2] Leigh & Butler, importers, Boston, Mass., in brief filed with the Ways and Means Committee Ma 1913.

The present (1920) production is undoubtedly larger than it was any of the years from 1910 to 1912, as the manufacturing equipment of domestic industries using card clothing has increased since that time, and the volume of annual imports has remained about the same. In 1912 the total number of spindles in American cotton mills was 31,582,679, and in 1920 the total had increased to 35,834,463, or nearly 13½ per cent. Similar data for the wool industry are not available, but indications are that the increase, if any, was much smaller, and the foregoing percentage, therefore, can not be taken as representative of the increase in production of card clothing.

Raw materials.—The materials used are wire, leather, cotton cloth, linen cloth, rubber-faced cloth, felt-faced cloth, and many combinations of the same. The cloth is bought by the manufacturer of card clothing in the shape in which it appears in the finished article. The wire is either round or oval and of hard-tempered steel. Untempered wire is not as satisfactory, and its use is being rapidly discontinued. Highly polished wire is necessary, and for certain special clothing wire covered with a coating of tin is employed to prevent rust.

Up to a recent period all of the raw materials—both the cloth foundation and the steel wire—were imported from England. In 1912 about 50 per cent of American-made steel wire was used, whereas by 1915 less than 10 per cent of the steel wire used in cotton card clothing was imported.[1] At the present time (1920) practically all the foundation used in the manufacture of domestic card clothing is made in this country.

American manufacturers state that imported wire is not as uniform in temper as the American wire, and that some of it is rusty, which results in a higher finishing cost in the manufacture of clothing.

Under the act of 1913 a duty of 12½ per cent ad valorem is required on imports of cotton cloth foundation, 35 per cent ad valorem on cloth foundation composed of linen warp and woolen filling, and 15 per cent ad valorem on wire.

Equipment.—Wire machines which automatically insert the wire into the foundation cloth (in a form similar to a series of wire staples driven through the cloth), and grinding machines which grind the points and surface of wires to make the points desired, are employed. Most of the machinery is of American make, being largely manufactured in the establishments of card-clothing manufacturers themselves.

Methods of production.—To make a complete set of card clothing for a standard 40-inch revolving flat card requires 131½ square feet of card-cloth foundation and 110 pounds of wire. This produces 1⅛ square feet of wire surface, which is used on the different parts of the card as follows: Card cylinder, 44½ square feet; doffer, 24 square feet; and tops or flats, 26⅝ square feet.

American method.—For the cylinder the cloth is made into strips or fillets 2 inches wide, and for the doffer into fillets 1½ inches wide. For the flats, which are strips of cast iron about 42 inches long by 3 inches wide, 110 in number on each American card, it is made into narrow sheets called tops. The number of teeth varies according

[1] U. S. Department of Commerce; Miscellaneous Series No. 37. 1916.

to the purpose of the piece of clothing, the doffer and the flats having usually the same number of points, the cylinder slightly less.

Fillet clothing is made "rib set;" that is, with the crowns of the teeth on the back of the clothing running in staggered ribs or rows lengthwise of the fillet. The teeth are set into tops, so that the crowns of the teeth on the back side of the foundation are "twilled;" that is, they are set in diagonal lines like a piece of twilled cloth.

The common method of making card clothing in America is with four crowns in 1 inch on the back of the clothing, or eight points to 1 inch on the face, and is known as eight-crown clothing. From this it will be seen that a 2-inch fillet will have eight ribs on the back and a 1½-inch fillet six ribs, etc. Sometimes in special cases where a large number of points per square foot are desired, the clothing is made 10-crown; that is, with 10 points per inch in width on the face of the clothing or five points per inch on the back of the clothing.

Card clothing is made with automatic machinery of complicated design, which sets from 400 to 1,000 points a minute.

English method.—English card clothing for tops is often made with the teeth inserted according to a method known as the "plain" or "open set," in which the crowns, or backs, of the teeth overlap each other. The clothing is made 10-crown; that is, with 10 points per inch across the card. This method of setting the teeth is often used in the United States when a large number of points per square inch is desired.

Organization.—The efficient conduct of the business does not require large factories, though the amount of capital invested is said to be relatively large. The consumption of card clothing is limited to manufacturers of cards and to textile mills.

Geographical distribution.—Card clothing is made in sections of the United States where cotton and woolen mills are found. About one-half of the establishments are located in the State of Massachusetts; the rest are distributed among the States of Pennsylvania, Connecticut, North Carolina, South Carolina, and Georgia.

Domestic production and consumption.—Authentic statistics of the present production and consumption are not at hand. Roughly stated, the average annual output during years just prior to 1913 probably amounted to between 1,200,000 and 2,800,000 square feet, and imports from 225,000 to 325,000 square feet, practically all of which was consumed in this country.

The industry is sufficiently equipped to supply ordinary domestic demands.

Domestic exports.—There are no official statistics of exports of card clothing from the United States, and normally the American article is not sold, at least in significant quantities, in foreign countries.

During the European war (1914–1918) a limited amount of card clothing was exported to South America, Mexico, Canada, Japan, and some European countries.

FOREIGN PRODUCTION.

Card clothing is made in most foreign countries where textiles are manufactured; England is probably the largest producer, followed in order of importance by Germany, France, Spain, and Italy. In

1916 there were seven English manufacturers of card clothing who were also exporters to the United States.[1]

Foreign methods of production are practically the same as those employed in the United States.

IMPORTS.

Official statistics of imports of card clothing include only clothing not actually and permanently fitted to and attached to carding machines or parts thereof at the time of importing. The imports, in 1920, amounted to 278,527 square feet. Of this amount 1,352 square feet, or about one-half of 1 per cent, was manufactured with round iron or untempered round steel wire; 244,941 square feet, or 88 per cent, was manufactured with tempered round steel wire, and 32,234 square feet, or 12½ per cent, was manufactured with plated wire, or other than round iron or steel wire, or with felt face, wool face, or rubber face cloth containing wool. The ratio of this division in the character of the imports is roughly representative of earlier years.

Annual imports since 1910 ranged between 175,866 square feet in 1917 and 501,602 square feet in 1910. Except in 1917 when imports were abnormally low, the imports have not varied greatly from year to year since 1911, ranging between 200,000 to 300,000 square feet annually.

Official statistics do not show the sources of imports, but it is known that the largest amounts come from England and smaller amounts from Germany, France, and Belgium. Amounts imported from the latter three countries since 1914 have been very small.[2]

TARIFF HISTORY.

Card clothing was first specifically mentioned in the United States tariff in the act of 1883. In each succeeding act some change was made in the paragraph dealing with card clothing, either in wording or rate.

Card clothing manufactured from tempered steel wire.—In 1890 the duty on card clothing manufactured from tempered steel wire was raised from 25 to 50 cents a square foot; in 1894 the rate was lowered to 40 cents, and in 1897 it was raised to 45 cents. In the act of 1909 the rate was made the same as in the foregoing act, but in the act of 1913 all card clothing other than that manufactured with round iron or untempered round steel wire were grouped together and given an ad valorem rate of 35 per cent.

Other card clothing.—The rate of duty on card clothing other than that manufactured with tempered steel wire was not changed until 1894, when, in the act of that year it was lowered from 25 to 20 cents a square foot. The rate remained at 20 cents, without change in the wording of the paragraph, until the act of 1909 became a law. This act, besides specifying card clothing "not actually and permanently fitted to and attached to carding machines or to parts thereof at the time of importation," also separated the former classification into clothing "manufactured with round iron or un-

[1] The Cotton-Spinning Machinery Industry: U. S. Department of Commerce Miscellaneous Series No. 37.
[2] Replies to questionnaires.

tempered round steel wire," designating a rate of 20 cents a square foot on the same, and clothing "when manufactured with plated wire, or other than round iron or steel wire, or with felt face, or rubber face cloth containing wool," upon which a rate of 55 cents a square foot was placed.

The act of 1913 mentions card clothing in only two classes, clothing manufactured with round iron or untempered round steel wire being given an ad valorem rate of 10 per cent.

The various changes in the rates of duty under the different tariff acts did not make any great differences in the total amounts annually imported.

COMPETITIVE CONDITIONS.

Raw materials, cloth foundation and wire, used in the manufacture of card clothing are produced in the United States in sufficient quantities to meet the needs of domestic card clothing manufacturers, the foreign manufacturer having no particular advantage in this respect.

The most important foreign manufacturing countries of card clothing are England and Germany. These countries import cotton and wool for use in the manufacture of cloth foundation, whereas the United States produces its own cotton and much of its wool. Linen yarn, used in cloth foundation, is produced from domestic flax in both Great Britain and Germany, whereas the United States receives this material from foreign countries.

The lack of increase in amounts annually imported by the United States apparently indicates that the import duty of 35 per cent ad valorem has offset, at least in large measure, the difference in costs between foreign and domestic production of card clothing. Production costs abroad, however, are proportionately lowered by the depreciation of British and especially German currency and their greater purchasing power of the money within the borders of those countries as compared with the international exchange value.

COSTS.

The following costs of imported card clothing, under the 1909 and 1913 tariff acts, are given in a publication of the United States Department of Commerce issued in 1916.[1]

Costs per linear yard of imported cloth foundation for card clothing, 22 ounces weight per square yard, composed of linen warp and woolen filling:

Items.	May, 1911.	May, 1914.
Cost f. o. b. factory, England	$0.8190	[illegible]
Import duties (30 per cent in 1913, 35 per cent in 1914)	.4050	[illegible]
Freight transportation and other charges (6 per cent in 1913, 8 per cent in 1914)	.0486	[illegible]
Buying commission, etc	.0405	[illegible]
Total cost per yard delivered in United States	1.3041	1.[illegible]

[1] Miscellaneous Series No. 37.

[2] This cost was for an order placed Dec. 20, 1913. The price has been advancing since that date on account of abnormal conditions in England.

›ril 22, 1915, an order for 20 pieces of this foundation was
ı England at the following price per linear yard:

b. factory, England	$1.074
cent)	.374
r cent)	.085
nission, etc. (5 per cent)	.053
›er linear yard delivered in United States	1.586

per linear yard of imported cotton cloth foundation material,
ls in length by 54 inches in width, composed of No. 28 two-
› yarn, 68 threads to the square inch, and of No. 16 one-ply
ırn, 64 threads to the square inch:

Items.	May, 1913.	May, 1914.
actory, England	$0.1732	$0.1682
s (30 per cent in 1913, 12½ per cent in 1914)	.0519	.0210
›portation and other charges (6 per cent in 1913, 8 per cent in 1914)	.0103	.0134
nission, etc.	.0076	.0063
›ost per yard delivered in United States	.2430	.2109

lothing for a 40-inch revolving flat card requires 110 pounds
l, bright, hardened, and tempered steel wire. The imported
No. 32 and the domestic wire of the same kind and grade is

per pound of imported No. 32 steel wire, round, bright,
d, and tempered:

Items.	1912	1914
actory, England	$0.1133	$0.1123
(35 per cent in 1912, 15 per cent in 1914)	.0396	.0170
›portation, etc. (6 per cent in 1912, 8 per cent in 1914)	.0067	.0091
nission, etc.	.0056	.0056
›ost per pound delivered in United States	.1652	.1450

›ost of imported wire to the American manufacturer was
2 cents per pound by the reduction in tariff, bringing it
› 14.5 cents per pound. The cost of No. 33 wire, manufac-
ı the United States and delivered at the factory, in 1915,
›ents per pound.

the cost of making card clothing in the United States was
ly increased when American wire was used. American card
manufacturers state, however, that there are advantages in
merican wire which offset the difference in costs. The im-
wire is not as uniform in temper as the American wire, it is
, some of it is rusty, and imperfect wire can not be returned.
rfect wire is received from the American manufacturer,
', it is returned and replaced. The American wire being
iform in temper, does not cause much trouble in the machines
›es more perfect clothing, thus bringing the cost of finishing,
ually lower than if imported wire were used.

TARIFF CONSIDERATIONS.

American manufacturers claim that the duty provided for ca clothing should apply whether or not the clothing is attached machines or parts thereof. In view thereof the following classific tions have been suggested:

1. When manufactured with round iron or steel wire.
2. When manufactured with plated wire, tinned wire, or oth than round iron or steel wire, or with felt face, wool face, or rubb face cloth.

Card clothing (total)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compu ad valo rate
		Square feet.				*Per c*
1907		464,716	$327,890	$206,223	$0.71	
1908		354,276	255,625	158,012	.72	
1909		404,802	297,460	179,028	.73	
1910		501,602	376,119	225,904	.75	
1911		324,429	256,899	147,415	.79	
1912		224,248	184,785	103,868	.82	
1913		285,997	236,915	132,838	.83	
1914		216,945	184,771	70,470	.85	
1915		283,825	213,827	74,767	.75	
1916		238,623	202,351	70,514	.85	
1917		175,866	204,825	71,539	1.16	
1918		200,035	307,343	107,128	1.54	
1919		217,394	406,117	141,260	1.87	
1920		278,527	525,775	183,292	1.89	

Card clothing, not actually and permanently fitted to and attached to carding machin parts of—Manufactured with round iron or untempered round steel wire—Impor consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu comp ad va rat
		Square feet.				*Per*
1907	20 cents per square foot.	11,598	$12,574	$2,320	$1.08	
1908	do	5,650	7,000	1,130	1.24	
1909	do	12,531	12,324	2,506	.983	
1910 [1]	do	10,660	13,681	2,132	1.28	
1911	do	9,989	12,266	1,998	1.23	
1912	do	2,124	2,930	425	1.38	
1913	do	2,341	3,382	468	1.44	
1914 [2]	do	288	498	58	1.73	
1914 [3]	10 per cent	472	902	90	1.91	
1915	do	203	291	29	1.43	
1916	do	541	1,235	124	2.29	
1917	do	245	598	60	2.44	
1918	do	1,542	1,767	177	1.15	
1919	do	1,875	3,525	353	1.88	
1920	do	1,352	2,790	279	2.06	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.

hing, not actually and permanently fitted to and attached to carding machines, or of—Manufactured with tempered round steel wire—Imports for consumption—ue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Square feet.				*Per cent.*
.....	45 cents per square foot.	453,118	$315,316	$203,903	$0.696	64.67
.....	.....do.....	348,626	248,625	156,882	.713	63.10
.....	.....do.....	392,271	285,136	176,522	.727	61.91
.....	.....do.....	462,466	337,240	208,110	.729	61.71
.....	.....do.....	275,261	210,433	123,868	.764	58.86
.....	.....do.....	187,255	150,359	84,265	.803	56.04
.....	.....do.....	235,864	186,484	106,139	.791	56.92
.....	.....do.....	29,635	27,493	13,336	.928	48.51
.....	35 per cent.....	155,189	126,207	44,172	.813	35.00
.....	.....do.....	258,301	186,893	65,413	.724	35.00
.....	.....do.....	222,264	184,305	64,507	.829	35.00
.....	.....do.....	162,082	186,570	65,300	1.151	35.00
.....	.....do.....	186,317	279,339	97,769	1.499	35.00
.....	.....do.....	182,999	339,230	118,731	1.854	35.00
.....	.....do.....	244,941	474,510	166,079	1.937	35.00

, 1909, to June 30, 1910, under act of 1909.
to Oct. 3, 1913, under act of 1909.
1913, to June 30, 1914, under act of 1913.

thing, not actually and permanently fitted to and attached to carding machines, ts of—Manufactured with plated wire, or other than round iron or steel wire, or elt-face, wool-face, or rubber-face cloth containing wool—Imports for consump-Revenue.

year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Square feet.				*Per cent.*
.....	55 cents per square foot.	28,476	$25,198	$15,662	$0.885	62.16
.....	.....do.....	39,179	34,200	21,549	.873	63.01
.....	.....do.....	34,869	31,496	19,178	.903	60.89
.....	.....do.....	47,692	47,049	26,231	.986	55.75
.....	.....do.....	11,022	10,381	6,063	.942	58.40
.....	35 per cent.....	20,348	19,290	6,752	.948	35.00
.....	.....do.....	24,821	26,643	9,325	1.073	35.00
.....	.....do.....	15,818	16,811	5,884	1.063	35.00
.....	.....do.....	13,539	17,657	6,180	1.304	35.00
.....	.....do.....	12,176	26,237	9,183	2.155	35.00
.....	.....do.....	32,520	63,362	22,177	1.949	35.00
.....	.....do.....	32,234	48,475	16,935	1.501	35.00

, 1909, to June 30, 1910, under act of 1909.
to Oct. 3, 1913, under act of 1909.
1913, to June 30, 1914, under act of 1913.

Court and Treasury Decisions.

ɔs of card clothing with metal end plates and metal clips partly attached thereto were held properly classified as manuɔs of metal under paragraph 167 rather than as card clothing paragraph 124 of the act of 1913. (G. A. 79193, T. D. 36838.)
l clothing manufactured from untempered round steel wire is le at 10 per cent under paragraph 124, while the steel wire vhich it is manufactured is dutiable at 15 per cent under para-114.

Card clothing—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty; specific and ad valorem.
1883	411	Card clothing	25 cents per square foot.
		When manufactured from tempered steel wire	45 cents per square foot.
1890	159	Card clothing, manufactured from tempered steel wire	50 cents per square foot.
		All other	25 cents per square foot.
1894	132	Card clothing, manufactured from tempered steel wire	40 cents per square foot.
		All other	20 cents per square foot.
1897	146	Card clothing, manufactured from tempered steel wire	45 cents per square foot.
		All other	20 cents per square foot.
1909	145	Card clothing not actually and permanently fitted to and attached to carding machines or to parts thereof at the time of importation, when manufactured with round iron or untempered round steel wire.	20 cents per square foot.
		When manufactured with tempered round steel wire	45 cents per square foot.
		When manufactured with plated wire, or other than round iron or steel wire, or with felt-face, wool-face, or rubber-face cloth containing wool.	55 cents per square foot.
1913	124	Card clothing not actually and permanently fitted to and attached to carding machines or to parts thereof at the time of importation, when manufactured with round iron or untempered round steel wire.	10 per cent ad valorem.
		When manufactured with tempered round steel wire, or with plated wire or other than round iron or steel wire, or with felt-face, or wool-face, or rubber-face cloth containing wool.	35 per cent ad valorem.

UMBRELLA HARDWARE.

SUMMARY.

There are about 8 or 10 manufacturers of umbrella hardware and essories in the United States.

Statistics of capital and production in definite amounts are not at ad; however, the total capital invested in the domestic industry, ughly stated, is several millions of dollars, and the annual produc- n from one and a quarter to two million dollars.

The industry is located chiefly in Pennsylvania.

Imports come mostly from England and Germany, and in the al year 1920 amounted to $11,607. Shortly after the beginning the war in Europe (1914–1918) there were decided annual de- ases in amounts imported; after the conclusion of peace the import vement showed a tendency to increase.

Exports are made to several countries, but the annual totals are t known.

There are no particular indications that the American industry is any great disadvantage as compared to the industry in foreign untries.

Umbrella hardware—Summary table.

Year.[1]	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
				Per cent.
	$18,348.00	$9,174.00	.....	50.00
	10,566.00	5,283.00	.....	50.00
	17,085.00	8,543.00	.....	50.00
	23,383.00	11,692.00	.....	50.00
	28,985.00	11,043.00	.....	[2] 38.10
	23,643.00	8,275.00	.....	35.00
	4,550.00	1,593.00	.....	35.00
	936.00	328.00	.....	35.00
	1,010.00	354.00	.....	35.00
	477.00	167.00	.....	35.00
	11,607.00	4,062.00	.....	35.00

[1] Fiscal years ending June 30. [2] Change in rate of duty from 50 to 35 per cent, by act of 1913.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

PAR. 141. Umbrella and parasol ribs and stretchers, composed in ief value of iron, steel, or other metal, in frames or otherwise, and bes for umbrellas, wholly or partially finished, 35 per cent ad lorem.

DESCRIPTION.

Umbrella hardware includes ribs, stretchers, tubes, notches, caps, se rings, tip cups, and all other parts, except handles and covers,

that enter into the manufacture of umbrellas, all of which, except ribs, stretchers, and tubes, are classed as umbrella furniture.

Wooden sticks not included.

DOMESTIC PRODUCTION.

Raw materials.—Fully 99 per cent of the metal parts of umbrellas and parasols are made from steel rods and sheet steel. Case rings are ordinarily made from sheet brass and notches from alloyed metal.

Prior to the war (1914-1918) steel rods used in making paragon ribs were imported from Sweden, because of their superiority over the American product. After the beginning of the war supplies from Sweden were cut off and manufacturers were obliged to use domestic material, which resulted in a product of inferior quality.

Equipment.—The machinery used by American umbrella manufacturers is made in the establishments of the manufacturers and is designed especially for the manufacture of umbrella hardware. The special design of the machinery prohibits its use in any other industry without considerable expense for alterations.

Methods of production.—Although machinery is used exclusively in making umbrella hardware, each machine performs but one operation at a time and requires the undivided attention of one operator. Both male and female operators are employed.

Steel tubes are made from sheet steel, swaged and brazed, plugged and swaged, slotted and punched. Into this is inserted a thumb spring, usually of alloyed metal, made on presses. The ferrule end is nickel plated and the entire tube is japanned.

In the manufacture of complete umbrella frames, before the addition of covers and handles, raw materials are said to represent about 35 per cent and labor and overhead 65 per cent of the total cost.[1]

Organization.—There are about 8 or 10 manufacturers of umbrella hardware and accessories in the United States. According to estimates furnished to the tariff commission by manufacturers, the capital invested is several millions of dollars, and the value of the annual production from $1,250,000 to $2,000,000.[1] In 1913 the industry employed about 1,500 persons.[1]

Geographical distribution.—The domestic industry is located in the industrial area of eastern United States, chiefly Pennsylvania.

Domestic production and consumption.—The quantity and value of the annual domestic production and consumption of umbrella hardware are not definitely known. While the annual production has been estimated, as above mentioned, the annual consumption can be but vaguely calculated. Thus, by taking into consideration that imports are comparatively small and exports have shown some activity only in recent years, it would seem there can be no very great difference between the figures of annual consumption and the figures of annual production.

The capacity of American establishments is sufficient to supply domestic demands.

Domestic exports.—Umbrella hardware is exported to England, France, Spain, Australia, India, South America, and some other countries, but the total amount and value of the annual exportation is difficult to ascertain. It is known, however, that exports of the domestic product to foreign markets have increased since 1914.

[1] Letters from manufacturers.

FOREIGN PRODUCTION.

England and Germany were important factors as competitors in e foreign trade prior to the war (1914–1918), it being claimed by e American manufacturer that the English and German manu-cturers controlled many of the most important European and uth American markets, from the fact that they were able to sell eir product at prices considerably below the American cost.[1]

IMPORTS.

Foreign umbrella hardware in the United States comes chiefly om England and Germany, and it is stated that these two countries pply about 95 per cent of the foreign business.[1]

In the fiscal year 1919 the imports were valued at $477, this being e smallest annual importation on record since 1884. In the fiscal ar 1914, the last normal year before the war, the amount was 8,985. After that year the annual imports decreased steadily until 20, when the amount increased somewhat to $11,607.

TARIFF HISTORY.

The act of 1894 increased the rate of import duty from 30 per cent l valorem to 50 per cent. The new rate remained in operation for er 19 years, after which it was reduced to 35 per cent by the act 1913.

There were slight increases in imports in the two years immediately llowing the reduction in the rate. While imports declined soon ter the outbreak of the war, the subsequent decrease was doubtless used by a scarcity of umbrella hardware in the foreign exporting ountries and can not be accepted as proof that domestic manufac-rers were better able to meet foreign competition.

COMPETITIVE CONDITIONS.

American manufacturers are well equipped with efficient machinery, hich is made in their own establishments, and it may be said that he English and German producers have no advantage over American roducers in manufacturing efficiency.

In procuring Swedish steel rods for making umbrella and parasol ibs, England and Germany may have some advantage in lower ransportation costs because of closer proximity to the source of upply. On the other hand, wages in the European countries which efore the war (1914–1918) were very much lower than in the United tates, have advanced to higher levels, so that at the present time 920) the difference in labor costs in the American and European dustries are not so great as formerly; especially is this so when nsidered in connection with the cost of living. The manufacture umbrella ribs was first invented in Stourport, near Sheffield, ngland, and English wire-drawing plants have successfully com-ted with American works in the American market for special ctions.[2]

[1] Letters from manufacturers.

[2] See survey on "All other wire."

Umbrella and parasol ribs and stretchers of iron, steel, or other metal in frames or otherwise, and tubes for umbrellas, wholly or partly finished—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Annual computed ad valorem rate.
						Per cent.
1910	50 per cent		$18,348	$9,174		50
1911	do		10,566	5,283		50
1912	do		17,085	8,543		50
1913	do		23,383	11,692		50
1914	do		5,985	2,993		50
	35 per cent		23,000	8,050		35
1915	do		23,643	8,275		35
1916	do		4,550	1,593		35
1917	do		936	328		35
1918	do		1,010	354		35
1919	do		477	167		35
1920	do		11,607	4,062		35

COURT AND TREASURY DECISIONS.

Grooved ribs or paragon ribs for umbrellas, with rivets, bolts, and balls complete, made from materials of which flat steel wire twenty-five one-thousandths of an inch thick or thinner was the component of chief value, were held to be properly classified under the proviso to paragraph 148 of the act of 1890 imposing 50 per cent ad valorem on such wire. (G. A. 1462, T. D. 12911 of 1892.)

Lacquered steel tubes closed at one end with a ferrule, and known in trade as ribs for umbrellas, were held dutiable as umbrella parts under paragraph 155½ rather than as parts of umbrellas under paragraph 361 of the act of 1894. (G. A. 3124, T. D. 16295 of 1895.)

Hollow metal rods having springs and catches inserted therein, designed for use in umbrellas, and commercially known as umbrella tubes, were held entitled to entry as tubes not specially provided for at 35 per cent under paragraph 152 of the act of 1897, as against the Government's contention that they were dutiable as manufactures of metal (G. A. 4998, T. D. 23302 of 1901). As a result of this litigation, specific provision was made in paragraph 170 of the act of 1909 for "tubes for umbrellas, wholly or partially finished."

Umbrella hardware—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883	491	Umbrella and parasol ribs, and stretcher-frames, tips, runners, handles, or other parts thereof, when made in whole or in chief part of iron, steel, or any other metal.	40 per cent ad valorem.
1883	492	Umbrellas, parasols, and sunshades, frames and sticks for, finished or unfinished, not specially enumerated or provided for in this act.	30 per cent ad valorem.
1890		Not enumerated	
1894	155½	Umbrella and parasol ribs, and stretcher frames, tips, runners, handles, or other parts thereof, made in whole or in chief part of iron, steel, or any other metal.	35 per cent ad valorem.
1897	170	Umbrella and parasol ribs and stretchers, composed in chief value of iron, steel, or other metal, in frames or otherwise.	Do.
1909	170	Umbrella and parasol ribs and stretchers, composed in chief value of iron, steel, or other metal, in frames or otherwise, and tubes for umbrellas, wholly or partly finished.	Do.
1913	141	Umbrella and parasol ribs and stretchers, composed in chief value of iron, steel, or other metal, in frames or otherwise, and tubes for umbrellas, wholly or partially finished.	35 per cent ad valorem.

MANUFACTURES OF WIRE.

SUMMARY.

This survey includes wire cloth and innumerable minor wire products. It does not include wire rope and cable, wire nails and spikes, woven-wire fencing, poultry netting, and wire heddles.

The *value of the product* in 1914 was approximately $36,000,000. Wire-cloth weaving requires expensive machinery, but many of the minor wire manufactures are made largely by hand. Some manufactures of wire are produced in establishments devoted mainly to that industry; others are produced as a minor product in other industries.

Exports are important but statistics are available only for manufactures of iron and steel wire (1913–1918), thus excluding some products covered by this survey and including some which should be excluded, mainly wire rope and cable. These exports increased from $1,553,426 in 1913 to $8,113,945 in 1917. In 1918 wire rope and cable for the first time were segregated, and, exclusive of this item, exports of manufactures of iron and steel wire amounted to $4,480,290, of which exports to the value of $1,478,496 went to North America; $1,327,427 to Europe; $771,844 to South America; $457,886 to Oceania; $434,782 to Asia; and $109,855 to Africa. The heaviest exports were to Canada, England, Russia, Australia, and Cuba.

Imports of manufactures of wire have been small, decreasing from $259,025 in 1913 to $190,280 in 1918. Imports of manufactures of wire by countries are grouped together with imports of wire, and these imports in 1913 came mainly from the United Kingdom, Germany, and France; in 1918, mainly from the United Kingdom, Canada, France, and Sweden.

The average imports of manufactures of iron or steel wire during the years 1907–1919 were 613,454 pounds, valued at $212,892, and paying a duty of $79,644, equivalent to 37 per cent; during the years 1911–1913 average imports were 574,562 pounds, valued at $147,108, and paying a duty of $72,895, equivalent to 49 per cent; during 1915–1918 average imports were valued at $177,535, paying a duty of $26,631, or 15 per cent ad valorem. The quantity imported during the latter period is not specified.

American manufacturers of wire products have a distinct advantage in an abundant and relatively cheap supply of raw material. This is particularly important in the case of the heavier wire products, in which the cost of the wire is a major element in total cost.

Manufactures of wire—Summary table.

Year.[1]	Domestic production (value).	Imports for consumption (value).	Domestic exports.	Ratio to production.[2]		Value imports for consumption.[3]	Amount of duty.	Value per pound.	Actual ratio to total value rate
				Imports.	Exports.				
		Per cent.		*Per cent.*	*Per cent.*				*Per cent.*
1910		171,715				$63,229	$21,475	$0.368	34.0
1911		651,656				150,899	62,075	.232	41.1
1912		629,884				197,963	80,353	.314	40.6
1913		785,246	$1,233,426			254,025	133,711	.330	52.6
1914	$36,000,000	4 178,329	1,750,622		4.8	309,317	65,285		21.1
1915			2,476,614			213,175	31,902		14.9
1916			7,662,198			289,702	43,456		15.0
1917			8,213,915			240,915	35,587		15.0
1918			1,089,280			190,280	28,542		15.0
1919						188,902	28,336		15.0
1920			3,677,127			189,113	28,413		15.0
1919			5,060,491			245,327	36,686		15.0

[1] Census year.
[2] Fiscal year ending June 30.
[3] Value of imports for consumption not available. The value given for 1914 is an estimate based on the census of 1915.
[4] July 1, 1913, to Oct. 3, 1913. Quantity and value not available after Oct. 3, 1913.
[5] Not available prior to 1913. Certain lines of iron or steel wire only. Does not include woven-wire fencing and wire nails and staples during 1914–1918, nor wire rope and cables during 1918.
[6] Percentages based on values.
[7] Calendar year.
[8] Includes manufactures of wire imported for the equipment of vessels on which the duty was remitted to the value of $72,112 in 1912, $1,250 in 1913, $10,778 in 1914, and $10,240 in 1915.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

PAR. 111. * * * articles manufactured wholly or in chief value of any wire or wires provided for in this section * * * 15 per cent ad valorem.

DESCRIPTION.

All manufactures of wire of any metal are included in this survey, except wire rope and cable, wire nails, spikes, and staples, woven-wire fencing and wire heddles and healds, which are specially provided for. For statistical convenience, poultry netting, which falls in this unit according to the tariff—i. e., treated in the unit devoted to woven-wire fencing. The most important manufactures of wire are wire nails, woven-wire fencing, wire rope and cable, and wire cloth, of which only the last named is included in this unit.

The minor wire products are innumerable, and include wire baskets, bird cages, buckles, broilers, ornamental fences, gates, flexible steel tubing, desk trays, fly killers, game traps, kitchen wire goods, milk-bottle carriers and racks, metal reinforcement for concrete construction, millstone wire, mats, porch swings, paper clips, rat traps, wire parts for textile machinery, wire springs, wire designs for florists, hooks, letter files, etc.

Wire cloth is a metal fabric woven of wire of various metals, namely, iron, steel, brass, bronze, copper, phosphorbronze, nickel, aluminum, or German silver. The classification of this article is determined by the number of wires to the linear inch and expressed as so many mesh, as No. 10 mesh, No. 60 mesh, etc. It is used in cement mills and by railroads, mining, and filter companies, and in many other industries. A common use is for window screens. In particular it is used under the name of Fourdrinier wire in paper mills. Fourdrinier

es are approximately from 60 to 80 mesh, only a very small pro-tion being finer than 80 mesh.

DOMESTIC PRODUCTION.

Materials.—The materials requisite for the wirework industry are efly iron, steel, brass, and copper wire, either round or flat, and of se the American manufacturer has an abundant supply at lower es than his European competitor must pay.

Methods of production and organization.—In a group as varied as e manufacturing industries there will naturally be found various thods of production and forms of organization. Bird cages, for mple, are made largely by hand labor and the industry comes o competition with hand labor in Germany, and other foreign coun-es. On the other hand, wire cloth and wire screen are woven much e cotton, woolen, and other fabrics—on looms especially built for purpose. The nature of the metal is such that very expensive chinery is necessary to weave wire of various gauges, so that a ge investment is required for plants.

Wirework is produced in wire-drawing mills, in wire departments rolling mills, and in other classes of establishments, as well as in ablishments devoted primarily to the production of wire manufac-es. The capital of the 552 establishments assigned by the census 1914 to the wirework industry was $38,509,000. The number of ge earners was 12,126 and the primary horsepower employed was ,547.

Geographical distribution.—The wirework industry (establishments gaged primarily in producing wirework) is not notably localized. e leading States in order of production in 1914 were Michigan, assachusetts, Illinois, Indiana, New York, Missouri, Ohio, and nnsylvania, the value of their product ranging from $5,891,000 for ichigan down to $3,409,000[1] for Pennsylvania. These eight States oduced about four-fifths of the total.

Domestic production and consumption.—The diverse classes of es-blishments producing manufactures of wire make it difficult to ow the value of wire goods manufactured. In 1914 establishments gaged primarily in the manufacture of wire other than rope and ble and woven-wire fencing produced to the value of $80,181,577. n the other hand, part of the output of establishments producing oven-wire fencing, as well as part of the output of wire-rope and ble establishments, consisted of other manufactures of wire. In dition to the foregoing, wire mills and wire departments of rolling ills produced woven-wire products of steel and iron, other than oven-wire fencing and poultry netting, nails, spikes, brads, tacks, aples, barbed wire, rope and strand, to the value of $2,822,689, other bricated-iron and steel-wire products valued at $8,899,208. More-ver, wirework apparently falling in this unit to the value of $2,064,336 as produced by establishments assigned to other classifications by e census, principally structural ironwork, and woven and other bricated copper-wire products to the value of $1,013,282. There main to be added to this list the wire manufactures of brass, erman silver, and other metals and alloys produced in wire depart-ents of rolling mills, which are not stated separately from wire pro-uced by these establishments. The total value of the wirework

[1] Including woven-wire fencing and wire rope and cable.

produced by the establishments here enumerated, exclusive of wire rope and cables, woven-wire fencing, and poultry netting, barbed wire, brads, tacks, staples, spikes and wire nails, was probably in excess of $36,000,000 in 1914.[1] Compared with this figure imports have been unimportant, having averaged, at least since 1910, less than 1 per cent.

Domestic exports.—The only export statistics available are those under the head of "all other manufactures of iron and steel wire" for years after 1913. These figures include all manufactures of iron and steel wire except woven-wire fencing and wire nails and spikes for the years 1913–1917, and all except woven-wire fencing, wire nails and spikes, and wire rope and cables after 1917. Barbed wire is classified as wire, not as a manufacture of wire.

With the exceptions noted, exports of manufactures of iron and steel wire increased from $1,553,426 in 1913 to $2,473,614 in 1915, jumped to $7,692,198 in 1916, and rose to over $8,000,000 in 1917. In 1918 there was an apparent decline to $4,480,290, but this was more than accounted for by the separate classification of wire rope and cable in that year, the exports of this article in 1918 amounting to $3,752,781.

The table on pages 202 and 203 shows exports to all countries to which exports in any one year from 1913 to 1918 amounted to $100,000. The leading countries in 1913 were Canada, England, Mexico, Cuba, and Australia, in the order named. In 1918, with wire rope and cables excluded, the leading countries were Canada, England, Russia, Australia, and Cuba.

In 1918 total exports to Europe were $1,327,427; to North America, $1,478,496; to South America, $771,844; to Asia, $434,782; to Oceania, $457,886; and to Africa, $109,855.

FOREIGN PRODUCTION.

The chief foreign producers normally competing in the domestic market are England,[2] Germany, France, Scotland, Canada, and Sweden. In the tariff hearings of 1913 Germany was mentioned as the chief competitor in wire fabrics.

IMPORTS.

The value of the imports of iron or steel wire included in this survey during the three years 1907–1909 averaged $212,892; during the three years 1911–1913, $147,108; and during the four years 1915–1918, $177,535. The average value of the imports of manufactures of copper wire during these three periods was $988, $2,370, and $6,616, respectively, and the average value of imports of manufactures of brass wire for the three periods was $23,219, $25,260, and $10,617, respectively.

Imports of manufactures of wire alone are not segregated by countries, but are shown under the head of "iron and steel wire and articles made from." The total imports under this head during the prewar years 1910–1914 varied from a minimum of $1,090,170 in 1912 to a maximum of $1,421,643 in 1911. During the war imports decreased steadily until in 1918 they amounted to only $309,577. The imports for consumption statistics quoted in the preceding paragraph indicate that probably only 10 to 20 per cent of these

[1] The five items, the value of which is specified above, total $35,993,515.
[2] See p. 190 for production in the United Kingdom and p. 191 for imports by countries.

imports consisted of manufactures of wire during the prewar years, but that a considerably larger proportion consisted of manufactures of wire during the later years. Of our imports of "iron and steel wire and articles made from," England during each year from 1910 to 1917 supplied considerably more than half, and in 1918 slightly in excess of one-third. In the prewar period, Germany ranked second, supplying in some years a little less and in some years a little more than one-fourth of the total. No other country supplied as much as 10 per cent of the total in any prewar year (1910–1914). After 1915 imports from Germany became of small importance while imports from Sweden and Canada increased. Imports from Sweden were at the maximum in 1917, amounting to $87,687 out of the total of $487,934, and imports from Canada were at the maximum in 1918, amounting to $92,404, out of a total of $309,571.

Imports of bird cages, wire strainers, and the coarser grades of wire cloth were shown in the tariff hearings to be directly competitive, but in 1912 it was stated that no cloth finer than 100 mesh was manufactured in this country.

PRICES.

Because of the great variety of articles included in this survey it has been impracticable to quote prices. Few price statistics are readily available. On page 205 are quoted the prices, as given in the Hardware Age, on screen cloth. The price of 12-mesh screen cloth painted black rose from $1.20 per 100 square feet in January, 1913, to $2.40 in January, 1919, falling to $2.25 by July, 1919. The price of galvanized screen cloth of the same mesh rose from $1.75 per 100 square feet in January, 1913, to $2.80 in January, 1919, and up to $2.90 by December 24, 1919. The price of bronze screen cloth, 14 mesh, rose from $5 per 100 square feet in January, 1913, to $10 in January, 1919, receded to $8.75 in July, 1919, and rose again to $10.25 by December 24, 1919.

TARIFF HISTORY.

The duties on manufactures of wire have been largely based upon the rates on the wire from which they are made.

The act of 1894 imposed a specific duty of from 1¼ to 2 cents per pound upon round iron or steel wire, the higher duty being on the small sizes. On all iron or steel wire valued above 4 cents per pound a duty of 40 per cent ad valorem was imposed, this duty being alternative to the specific duty, not additional. Manufactures of iron or steel wire paid the maximum rate of duty imposed upon any wire used in their manufacture and 1 cent per pound in addition. Manufactures of other wire than iron and steel paid a duty of 35 per cent ad valorem.

The act of 1897 retained the specific duty of 1¼ to 2 cents per pound on round iron or steel wire, with the proviso that all such wire valued at more than 4 cents per pound should pay a duty of not less than 40 per cent ad valorem. Other wire paid 45 per cent. All iron or steel wire coated with zinc, tin, or other metal paid two-tenths of 1 cent per pound in addition. Articles manufactured from iron, steel, copper, or wire paid 1¼ cents per pound in addition to the rate imposed upon the wire from which they were manufactured. Other manufactures of wire paid 45 per cent ad valorem under a basket clause (par. 193).

The act of 1909 retained the specific duty on round iron or steel wire, but placed it at 1 to 1¾ cents per pound, a slight reduction. The minimum rate for wire of this class was reduced from 40 per cent to 35 per cent, but was not applied to all such wire, and not restricted as before to wire valued at more than 4 cents per pound. All other wire was made dutiable at 35 per cent ad valorem. The additional duty of two-tenths of 1 cent per pound was retained on iron or steel wire coated with zinc, tin, or other metal. The duty on manufactures of wire was fixed at 1 cent per pound in addition to the maximum rate on any wire used in their manufacture, but not less than 40 per cent ad valorem. A basket clause (par. 199) provided a duty of 45 per cent on manufactures of metal not specially provided for, and after 1912 manufactures of brass and bronze wires paid this rate plus 1 cent per pound.

The act of 1913 placed a uniform ad valorem rate of 15 per cent on all manufactures of wire not specially provided for. This rate applies to all articles included in this survey.

Because of their large number, all the different classes of wire manufactures shown on page 9 are discussed in detail. The influence of the tariff can be shown by considering imports of three groups—manufactures of wires of iron or steel, of copper, and of brass, for three different periods under the acts of 1897, 1909, and 1913. During the three years 1907–1909, under the act of 1897 imports of manufactures of iron or steel wire averaged 613,454 pounds, valued at $212,892, and the average duty collected was $79,644, or the equivalent of 37 per cent ad valorem.

During the three years 1911–1913, under the act of 1909 the average imports of manufactures of iron or steel wire were 574,562 pounds, valued at $147,108, and the duty collected averaged $72,895, or the equivalent of 49 per cent ad valorem. During the four years 1915–1918, under the act of 1913 the average value of imports of manufactures of iron or steel wire was $177,535, and the duty collected $26,631, or 15 per cent ad valorem.

Imports of manufactures of copper wire averaged during 1907–1909 2,594 pounds, valued at $988, and paid duty to the amount of $477, or the ad valorem equivalent of approximately 48 per cent. During the three years 1911–1913 imports averaged 5,766 pounds, valued at $2,370, and the average duty paid was $1,047, equivalent to 44 per cent ad valorem. During the four years 1915–1918 the value of these imports averaged $6,616 and the duty collected $993, or 15 per cent.

Imports of manufactures of brass wire during 1907–1909 averaged in value $23,219 and the duty collected $10,793, or approximately 46 per cent. During 1911–1913 the average value of imports was $25,260, the average duty collected $11,247, or the equivalent of 44 per cent. During 1915–1918 the average value of imports was $10,617 and the average duty collected $1,209, or 11 per cent.

Imports of manufactures of bronze wire are not shown before 1913. In 1913, under the act of 1909 they were valued at $28,211 and the average rate of duty was 47 per cent. During the first three months of the fiscal year 1914, under an average duty of 47 per cent, they amounted to $20,942, and during the last nine months of that year to $64,252 under the lower duty of 15 per cent. In 1915 they were valued at $31,414 and during the three years 1916–1918 aggregated less than $7,000.

orts of manufactures of wire of metal compositions, n. e. s., alued at $26,411 in 1913, under an average duty of 47 per cent; 1915, $10,916; in 1917, $41,398; and in 1918, $56,371, under ver duty of 15 per cent.

COMPETITIVE CONDITIONS.

rican producers of manufactures of wire have a distinct ad- e in an abundant and relatively cheap domestic supply of teel, brass, bronze, and copper wire, the chief raw materials. costs more than foreign labor. In articles produced largely by abor, as bird cages, or in which the raw material is relatively ortant as compared with labor, domestic producers have the ifficulty in meeting foreign competition. In the case of wire t has been urged by manufacturers that a flat ad valorem rate ot adequately protect the producers of the finer meshes. In arser grades less labor is required relatively to the value of the aterial and a low duty gives adequate protection. In the finer more labor is required to produce a square foot and a higher s required. On the whole, our import and export statistics e that American manufacturers are more than holding their They supply 99 per cent of domestic consumption and export roducts to the value of millions of dollars annually. However, he revival of industry in Europe our imports will probably e of those manufactures of wire in which labor is the chief ele- f cost and raw materials and cost of plants are less important.

TARIFF CONSIDERATIONS.

ne tariff hearings of 1908–9 manufacturers of wire strainers l out the specific duty per pound then charged "amounted to g," wire strainers being made of very fine wire, generally , and being of fine mesh, and therefore weighing very little. ly German goods had been of inferior quality, but at that time s good as the domestic, and could be sold more cheaply in our .

Wirework [1]*—Production in United States.*

[From Federal Census.]

State.	1899 [2]	1904	1909	1914
	$1,394,464	$3,459,024	$5,284,870	$5,891,000
etts	3,004,955	3,708,586	3,231,779	4,878,000
	1,825,729	3,759,895	3,320,972	4,682,000
	1,099,723	1,696,289	3,161,083	3,732,000
	1,203,830	2,336,207	3,396,279	3,484,000
nia	1,528,375	2,517,151	3,619,634	3,435,000
	2,280,474	3,511,990	3,069,516	3,409,000
r	2,424,492	3,638,901	5,875,153	3,394,000
	1,102,643	2,261,225	2,745,398	2,654,000
t	882,564	839,740	1,547,598	1,361,000
	1,245,693	2,630,267	3,345,118	1,330,000
	638,797	652,676	892,304	1,299,000
	1,311,143	2,056,544	2,448,248	2,240,000
l	19,942,882	33,038,495	[3] 41,937,952	[4] 41,789,000

[1] Products made in establishments not drawing wire.
[2] Includes custom work and repairing.
[3] Fence, $11,695,811; wire cloth and wire rope, $10,362,588; both wire fence and wire cloth and wire 0,442.
[4] Including woven wire fencing, $15,132,000; wire rope and cable, $5,463,000; and barbed wire.

All other wirework, including barbed wire (wire products made by firms not drawing wire, except wire rope and cable and woven wire fencing)—Production in United S (calendar year).

[From Federal Census.]

Value, 1914, $21,194,000.

Other [1] woven wire products, made in wire mills purchasing wire rods—Productio United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1909, included under woven wire fence and poultry netting; 1914, 8,84 tons, $915,490.

Other [1] woven wire products made in wire departments of rolling mills—Productio United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1909, included under woven wire fence and poultry netting; 1914, 14,19 tons, $1,907,199.

Other fabricated iron and steel wire products, made in wire mills purchasing wire ro Production in United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1919, 71,906, $6,130,901; 1914, 54,211, $4,946,444.

Other fabricated iron and steel wire products, made in wire departments of rolling mi Production in United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1909, 53,239, $3,474,953; 1914, 68,509, $3,952,764.

Woven and other fabricated copper wire products, made in wire mills purchasing wire ro Production in United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1909, 186, $94,918; 1914, 499, $291,380.

Woven and other fabricated copper wire products, made in wire departments of rolling mi Production in United States (calendar years).

[From Federal Census.]

Quantity (short tons), 1909, 14,563, $4,752,972; 1914, 1,631, $721,902.

Manufactures of wire 1907—Production in principal foreign countries.

Country.	Returned on schedules for the wire trades.[1]	Returned on schedules for other trades.[1]	Total.
United Kingdom:[2]			
Iron and steel—			
Ropes and cables	$7,017,193.50	$661,944.00	$7,679,13
Netting	2,345,653.00	433,118.50	2,778,77
Mattresses	200,259.50	1,479,416.00	1,688,67
Nails and staples	131,395.50	136,262.00	267,65
Small wares and other manufactures	2,467,315.50	759,174.00	3,226,49
Total iron and steel	12,171,117.00	3,469,914.50	15,640,91
Brass and copper	778,640.00		778,64

[1] Other than woven wire fence and poultry netting. [2] Census of Production, 1907.

n and steel wire and articles made from—Imports by countries (fiscal years).

nported from—	1910	1911	1912	1913	1914	1915
	$915,064	$854,912	$612,275	$748,452	$790,337	$641,963
	63,482	48,533	60,031	54,253	74,209	58,125
	307,545	417,028	330,256	297,791	291,502	130,537
	63,311	90,557	71,833	45,905	50,952	39,330
	19,024	129	50	4,998	12,794	12,492
	1,133	3,372	6,292	6,653	21,874	23,010
	13,252	7,112	9,433	16,279	22,394	20,074
tal	1,382,811	1,421,643	1,090,170	1,174,331	1,264,062	925,531

Imported from—	1916	1917	1918	1918[1]	1919[2]
	$323,879	$248,974	$104,754	$122,893	$195,821
	67,822	67,663	57,980	39,055	75,425
	18,390	2,642	477	.....	14,118
	14,298	1,705	.....	.....	3
	42,376	87,687	38,051	2,877	987
	56,043	56,692	92,404	103,214	145,607
	25,313	22,571	15,905	5,666	31,093
tal	548,121	487,934	309,571	273,705	463,054

:ts for consumption statistics indicate that the larger part of the imports here shown consists of dar years.

Manufactures of iron or steel wire—Imports for consumption—Revenue.

[Summary table showing totals for items on pp. 193-204.]

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
		727,246	$228,696	$90,061	.....	.....
		604,491	218,974	81,611	.....	.....
		508,624	191,007	67,260	.....	.....
erage		613,454	212,892	79,644	.....	37
		634,307	140,684	57,988	.....	.....
		533,010	153,230	98,919	.....	.....
		556,368	147,410	61,778	.....	.....
erage		574,562	147,108	72,895	.....	49

ictures of round iron or steel wire, valued at 4 cents or less per pound, not smaller than No. 13 wire gauge—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1½ cents plus 1½ cents per pound.	55,942	$9,385	$1,399	$0.168	14.90
.....	2½ cents per pound.	80,941	14,834	2,023	.183	13.64
.....	2½ cents per pound.	38,585	7,444	965	.193	12.96
.....	2½ cents per pound[1]	14,275	2,089	357	.146	17.08

[1] to Aug. 5, 1909, under act of 1897.

ictures of round iron or steel wire coated with zinc or tin or other metal, valued at ts or less per pound, not smaller than No. 13 wire gauge—Imports for consump- —Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$1\frac{3}{10}$ cents plus $1\frac{1}{2}$ cents per pound.	586	$79	$16	$0.135	20.13
.....	$2\frac{1}{10}$ cents per pound.	921	108	25	.117	23.03
.....	$2\frac{1}{10}$ cents per pound.	9,513	1,315	257	.138	19.53
.....	$2\frac{1}{10}$ cents per pound.[1]	500	240	14	.480	56.25

l to Aug. 5, 1909, under act of 1897.

ictures of round iron or steel wire, coated by dipping, galvanizing, or similar proc- with zinc, tin, or other metal, valued at 4 cents or less per pound—Imports for mption—Revenue.

[Smaller than No. 13 and not smaller than No. 16 wire gauge.]

al year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$2\frac{3}{8}$ cents per pound	53	$9	$2	$0.168	17.56
.....	....do.....	14	3	.....	.214	13.67
.....	....do.....	1,016	357	30	.352	8.39
.....	....do.[1]	.....	.....	.....	.....	.....

l to Aug. 5, 1909, under act of 1897.

ictures of round iron or steel wire, coated by dipping, galvanizing, etc., with zinc or other metal, valued at 4 cents per pound or less, smaller than No. 16 wire, —Imports for consumption—Revenue.

al year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	$3\frac{5}{10}$ cents per pound	70,145	$6,966	$2,420	$0.099	34.74
.....	....do.....	417	786	14	1.88	1.83
.....	....do.....	24,401	3,195	842	.131	26.35
.....	....do.[1]	6,173	714	213	.115	29.83

l to Aug. 5, 1919, under act of 1897.

ictures of round iron or steel wire, coated by dipping, galvanizing, or similar proc- ith zinc, tin, or other metal, valued at more than 4 cents per pound—Imports for mption—Revenue.

ıl year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.. ..	$\frac{5}{10}$-cent per pound and 40 per cent plus $1\frac{1}{2}$ cents per pound.	42,654	$6,764	$3,324	$0.159	49.14
.....	$1\frac{3}{10}$ cents per pound plus 40 per cent ad valorem.	10,558	6,365	2,699	.603	42.40
.....	....do.....	57,915	24,773	10,750	.428	43.39
.....	....do.[1]	18,721	7,189	3,143	.384	43.78

l to Aug. 5, 1909, under act of 1897.

Manufactures of hat, bonnet, crinoline, corset, needle wire, etc., and all wire N. S. P. F. valued at more than 4 cents per pound—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	45 per cent plus 1½ cents per pound.	42,290	$23,318	$11,022	$0.551	[illegible]
1908	do	21,913	8,359	4,035	.381	[illegible]
1909	do	11,663	8,590	4,011	.737	[illegible]
1910	do.[1]	1,680	1,545	716	.920	[illegible]

[1] July 1 to Aug. 5, 1909, under the act of 1897.

Manufactures of hat wire, bonnet wire, etc., coated with zinc, tin, or other metal—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	45 per cent plus 1½ cents per pound.	2,184	$372	$199	$0.17	[illegible]
1909	do	236	446	204	1.89	[illegible]

Manufactures of brass wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1½ cents per pound and 45 per cent.	24,821.75	$20,083	$9,348	$0.909	[illegible]
1908	do	32,907.15	25,276	11,786	.768	[illegible]
1909	do	24,950.40	24,299	11,246	.974	[illegible]
1910[1]	do	1,271.00	1,283	593	1.01	[illegible]

[1] July 1 to Aug. 5, 1909, under act of 1897.

Manufactures of copper wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1½ cents per pound and 45 per cent.	142	$53	$26	$0.373	[illegible]
1908	do	417	65	34	.156	[illegible]
1909	do	7,223	2,845	1,371	.394	[illegible]

Manufactures of aluminum wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1 cent per pound and 45 per cent.	[1] 5,796	$1,913	$919	$0.33	[illegible]
1908	do	[1] 1,288	747	349	.58	[illegible]

[1] Rope from aluminum wire.

ictures of round iron and steel wire, not smaller than No. 13 wire gauge—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	2 cents per pound..	425	$20	$9	$0.047	42.50
.....	.....do.....	2,135	93	43	.044	45.91
.....	.....do.....	110	4	2	.036	55.00

ictures of round iron or steel wire, smaller than No. 13, not smaller than No. 16 wire gauge—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	2½ cents per pound	15	$1	.....	$0.040	56.67
.....	.....do.....	2,780	88	$63	.032	71.08
.....	.....do.....	3,123	129	70	.041	54.47
.....	.....do.....	4,212	179	95	.042	52.96
.....	.....do.....	100	3	2	.030	75.00

g. 6, 1909, to June 30, 1910, under act of 1909. ³ July 1 to Oct. 3, 1913, under act of 1909.

ictures of round iron and steel wire, smaller than No. 16 wire gauge—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	2½ cents per pound.	1,746	$83	$48	$0.048	57.87
.....	.....do.....	46,532	2,328	1,286	.050	54.97
.....	.....do.....	13,728	645	378	.047	58.53
.....	.....do.....	10,344	507	284	.049	56.16
.....	.....do.....	5,254	295	144	.056	48.98

ug. 6, 1909, to June 30, 1910, under act of 1909. ³ July 1 to Oct. 3, 1913, under act of 1909.

ictures of round iron and steel wire, on the wire of which the specific duty does not amount to 35 per cent ad valorem—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	35 per cent ad valorem plus 1 cent per pound.	2,090	$120	$63	$0.057	52.42
.....	.....do.....	89,075	8,664	3,923	.097	45.28
.....	.....do.....	61,679	8,592	3,624	.139	42.18
.....	.....do.....	83,285	10,062	4,355	.121	43.28
.....	.....do.....	12,963	1,527	664	.118	43.49

ug. 6, 1909, to June 30, 1910, under act of 1909. ³ July 1 to Oct. 3, 1913, under act of 1909.

Manufactures of round iron or steel wire, on which the ordinary duty does not amount to 40 per cent ad valorem—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent*
1910[1]	40 per cent ad valorem.	25,061	$9,111	$3,645	$0.363	40.00
1911	do	301,326	103,523	41,409	.344	40.00
1912	do	239,972	97,157	38,863	.405	40.00
1912	Duty remitted for equipment of ships in foreign trade.	120	36		.300	
1913	40 per cent ad valorem.	237,462	88,223	35,289	.379	40.00
1914[2]	do	63,856	20,032	8,013	.314	40.00

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909. [2] July 1 to Oct. 3, 1913, under act of 1909.

Manufactures of round iron and steel wire coated by dipping, galvanizing, or similar processes with zinc, tin, or other metal, not smaller than No. 13 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1911	2½ cents per pound	3,360	$75	$74	$0.022	98.56
1912	do	1,577	46	35	.029	73.41
1913	do	385	21	8	.054	40.33

Manufactures of round iron or steel wire coated by dipping, galvanizing, or similar processes with zinc, tin, or other metal, smaller than No. 13 and not smaller than No. 16 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910[1]	2½ cents per pound	8,492	$741	$338	$0.040	45.59
1912	do	1,496	75	37	.050	49.87

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Manufactures of round iron and steel wire, coated by dipping, galvanizing or similar processes with zinc, tin, or other metal—smaller than No. 16 wire gauge—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910[1]	2½ cents per pound.	3,134	$174	$92	$0.055	52.87
1911	do	25,159	1,429	742	.057	51.93
1912	do	9,014	513	267	.057	51.95
1913	do	19,121	1,018	565	.054	54.24
1914	Duty remitted Panama act	12,857	524		.041	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

ures of round iron or steel wire coated by dipping, galvanizing, or similar process nc, tin, or other metal, on (the wire of) which the specific duty does not amount er cent ad valorem—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	35 per cent ad valorem plus $1\frac{3}{16}$ cents per pound.	1,330	$33	$29	$0.025	83.37
.....	.....do.....	53,608	3,899	2,009	.073	51.50
.....	.....do.....	68,665	6,910	3,242	.101	46.92
.....	.....do.....	135,393	9,064	4,797	.067	52.92
.....	Duty remitted; Panama act.	2,806	224	.....	.08	.....
.....	35 per cent ad valorem plus $1\frac{3}{16}$ cents per pound.	7,381	814	373	.11	45.88

:. 6, 1909, to June 30, 1910, under act of 1909. [2] July 1 to Oct. 3, 1913, under act of 1909.

ures of round iron and steel wire coated by dipping, galvanizing, or similar with zinc, tin, or other metal, on which the ordinary duty does not amount to ent ad valorem—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	40 per cent ad valorem.	1,883	$1,314	$526	$0.698	40.00
.....	.....do.....	15,293	5,009	2,004	.328	40.00
.....	.....do.....	44,369	21,180	8,472	.482	40.00
.....	.....do.....	8,405	4,713	1,885	.561	40.00

) Oct. 3, 1913, under act of 1909.

ures of wire of iron or steel, covered with cotton, silk, or other material, on which inary duty amounts to 40 per cent ad valorem—Imports for consumption— e.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	35 per cent ad valorem plus 1 cent per pound.	1,698	$295	$120	$0.174	40.76
.....	45 per cent ad valorem plus 1 cent per pound.	2,313	1,356	633	.586	46.71
.....	.....do.....	16	25	11	1.56	45.64

[1] Treasury decision 32600. [2] July 1 to Oct. 3, 1913, under act of 1909.

ures of wire of iron and steel covered with cotton, silk, or other material, on ie ordinary duty does not amount to 40 per cent ad valorem—Imports for con- on—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	40 per cent ad valorem.	151	$52	$21	$0.344	40.00
.....	.....do.....	5,756	1,407	563	.244	40.00
.....	.....do.....	14,866	4,609	1,845	.31	40.00

909, to June 30, 1910, under act of 1909.

Manufacturers of telegraph, telephone, and other wire and cables, composed of and rubber or of metal, rubber and other materials—Imports for consum Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Pounds.				P
1910[1]	1 cent per pound and 40 per cent.	5,820	$486	$253	$0.083	
1911	do	8,859	480	281	.054	
1912	do	6,878	580	301	.084	
1913	do	1,832	289	133	.158	
1913	Duty remitted, Panama act.	10,640	512		.048	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Manufactures of wire not specially provided for, on which the ordinary duty amo 40 per cent or more ad valorem—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Act con ad v r
		Pounds.				Pa
1910[1]	35 per cent ad valorem plus 1 cent per pound.	20	$1	$1	$0.050	
1911	do	36,709	4,740	2,026	.129	
1912	do	8,529	771	355	.09	
1913[2]	45 per cent ad valorem plus 1 cent per pound.	17,512	15,487	7,144	.884	
1914[3]	do	7,850	5,044	2,348	.643	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1, to Oct. 3, 1913, under act of 19
[3] Treasury Decision 32600.

Manufactures of wire not specially provided for, on which the ordinary duty do equal 40 per cent ad valorem—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu com ad v r
		Pounds.				Pa
1911[1]	40 per cent ad valorem.	29,295	$19,567	$7,827	$0.667	
1911	do	58,835	12,710	5,084	.216	
1911	do	84,337	27,806	11,122	.33	
1911	Duty remitted for equipment of vessels in foreign trade.	172	36		.209	

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Manufactures of wire not specially provided for, or metal compositions not els specified on which the ordinary duty amounts to 40 per cent ad valorem—Impo consumption Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu com ad v r
		Pounds.				Pa
1912[1]	45 per cent ad valorem plus 1 cent per pound.	3,511	$1,692	$797	$0.482	
1913	do	52,493	26,411	12,410	.503	
1914[2]	do	1,729	1,744	802	1.01	

[1] Treasury Decision 32600.
[2] July 1, to Oct. 3, 1913, under act of 1909.

uctures of wire not specially provided for, of metal comporitions on which the ıary duty does not amount to 40 per cent ad valorem—Imports for consumption—nue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	40 per cent ad valorem.	67,649	$26,548	$10,619	$0.39	40.00

uctures of brass wire on which the ordinary duty amounts to 40 per cent ad valorem or more—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1 cent per pound and 35 per cent.	255.00	$289	$104	$1.13	35.88
.....	.....do.....	407.00	48	21	.118	43.48
.....	.....do.....	485.00	57	25	.118	43.51
.....	1 cent per pound and 45 per cent.[1]	81,410.65	52,250	24,327	.642	46.56
.....	.....do.....	20,186.00	12,997	6,051	.644	46.55

[1] Treasury Decision 32600.

[2] July 1 to Oct. 3, 1913, under act of 1909.

uctures of brass wire on which the ordinary duty does not amount to 40 per cent—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	40 per cent.....	5,546.00	$5,025	$2,010	$0.906	40.00
.....	.....do.....	12,951.71	8,800	3,520	.679	40.00
.....	.....do.....	20,333.50	14,624	5,850	.719	40.00

6, 1909, to June 30, 1910, under act of 1909.

Manufacture of bronze wire—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1 cent per pound and 45 per cent.	60,233	$28,211	$13,297	$0.468	47.14
.....	.....do.....	46,974	20,942	9,894	.446	47.24

to Oct. 3, 1913, under act of 1909.

Manufactures of copper wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910	40 per cent ad valorem.[1] [2]	239	$114	$50	$0.477	40.00
1911	35 per cent ad valorem plus 1 cent per pound.	12	2	1	.167	50.00
	40 per cent ad valorem.[2]	3,979	1,365	546	.343	40.00
	35 per cent ad valorem plus 1 cent per pound.	10	2	1	.20	50.00
1912	45 per cent ad valorem plus 1 cent per pound.[3]	395	151	72	.382	47.68
	40 per cent ad valorem.[2]	4,318	1,620	648	.375	40.00
1913	45 per cent ad valorem[3] plus 1 cent per pound.	8,583	3,972	1,873	.463	47.16
1914[4]	45 per cent ad valorem[3] plus 1 cent per pound.	3,606	1,655	781	.459	47.19

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] Manufactures of wire on which the ordinary duty does not amount to 40 per cent.
[3] Treasury Decision 32600.
[4] July 1 to Oct. 3, 1913, under act of 1909.

Manufactures of aluminum wire—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1912	40 per cent	3	$3	$1	$1.00	40.00
1913[1]	45 per cent[2]	41	35	16	.854	45.00

[1] Includes wire and manufactures of wire. [2] Treasury Decision 32600.

All other manufactures of wire, not specially provided for—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1914[1]	15 per cent ad valorem.		$131,462	$19,719		15
1915	do		179,808	26,971		15
1916	do		246,506	36,977		15
1917	do		170,142	25,521		15
1918	do		113,686	17,053		15
1919	do	254,185	123,720	18,558		15
1920	do	470,780	201,561	30,234		15
1918[2]	do		116,016	17,402		15
1919[2]	do	218,767	161,475	24,221		15

[1] Oct. 1, 1913, to June 30, 1914, under act of 1913. [2] Calendar years.

Wire fencing composed of wire not larger than $\frac{3}{16}$ inch nor smaller than $\frac{1}{16}$ inch in diameter is admitted free and not included here. Other manufactures of wire not included here are wire rope, wire bedsteads or beds, and wire nails, staples, etc., and manufactures of wire of brass, bronze, copper, aluminum, and metal compositions not otherwise specified.

Manufactures of brass wire—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	15 per cent	.....	$13,178	$1,977	.....	15
.....	Free for construction and equipments of vessels.	.....	10,778	.....	.....	.....
.....	15 per cent	.....	8,639	1,296	.....	15
.....	Free for construction and equipment of vessels.	.....	10,230	.....	.....	.....
.....	15 per cent	.....	7,162	1,074	.....	15
.....	.....do	.....	12,005	1,801	.....	15
.....	.....do	.....	4,433	665	.....	15
.....	.....do	.....	14,358	2,154	.....	15
.....	.....do	.....	4,404	661	.....	15
.....	.....do	.....	9,427	1,414	.....	15
.....	Free (sec. 4, J 5)	.....	1,821	.....	.....	.....
.....	15 per cent	.....	12,676	1,901	.....	15
.....	Free (sec. 4, J 5)	.....	745	.....	.....	.....

1913, to June 30, 1914, under act of 1913.
ar years.
e construction and equipment of vessels.

Manufactures of bronze wire—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	15 per cent	.....	$64,252	$9,638	.....	15
.....	.....do	.....	31,414	4,712	.....	15
.....	.....do	.....	1,092	164	.....	15
.....	.....do	.....	2,975	446	.....	15
.....	.....do	.....	2,533	380	.....	15
.....	.....do	.....	10,604	1,591	.....	15
.....	.....do	.....	44,286	6,643	.....	15
.....	.....do	.....	5,977	897	.....	15
.....	.....do	.....	33,094	4,964	.....	15

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913. [2] Calendar years.

Manufactures of copper wire—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
r:		*Pounds.*				*Per cent.*
.....	15 per cent	.....	$3,020	$453	.....	15
.....	.....do	.....	2,168	325	.....	15
.....	.....do	.....	1,190	179	.....	15
.....	.....do	.....	10,395	1,559	.....	15
.....	.....do	.....	12,709	1,906	.....	15
.....	.....do	.....	16,564	2,485	.....	15
.....	.....do	.....	9,089	1,363	.....	15
ear:						
.....	.....do	.....	16,447	2,467	.....	15
.....	Free (sec. 4, J 5)	.....	2,236	.....	.....	.....
.....	15 per cent	.....	14,956	2,243	.....	15

[1] construction and equipment of vessels.

Manufactures of aluminum wire—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad valorem rate
		Pounds.				*Per cent*
Fiscal year:						
1914 [1]	15 per cent ad valorem.		$29	$4		
1916	do		33,586	5,038		
1918 [2]	do		548	82		
1919	do					
1920	do		337	51		

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913. [2] Wire included.

Manufactures of wire of metal and metal compositions, n. e. s.—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad valorem rate
		Pounds.				*Per cent*
Fiscal year:						
1914 [1]	15 per cent		$16,839	$2,526		
1915	do		10,916	1,637		
1916	do		167	25		
1917	do		41,398	6,210		
1918	do		56,371	8,456		
1919	do		23,656	3,548		
1920	do		15,965	2,395		
Calendar year:						
1918	do		28,219	4,233		
1919	do		22,381	3,357		

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.

All other manufactures of iron and steel wire [1]—Domestic exports (fiscal years).

Exported to—	[2] 1913	1914	191
England	$259,768	$262,168	$9
France	2,444	7,231	2
Italy	90	41	
Norway	3,852	75	
Spain	1,256	1,638	
Russia in Europe	20	746	
Canada	430,288	365,327	3
Panama	74,682	96,680	1
Mexico	119,945	108,090	1
Cuba	96,412	90,239	1
Argentina	14,663	16,776	
Brazil	60,598	45,732	
Chile	44,602	44,433	
Colombia	15,657	19,543	
China	2,813	29,716	
British India	7,696	16,638	
Japan	24,883	19,794	
Russia in Asia		1,482	
Australia	90,233	258,994	1
All other	300,544	355,299	3
Total	1,553,426	1,740,622	2,0

[1] Does not include woven-wire fencing and wire nails and spikes during 1913–1918, nor wire rope cables in 1918.
[2] Manufactures of wire not specified before 1913.

manufactures of iron and steel wire—Domestic exports (fiscal years)—Contd.

Exported to—	1916	1917	1918
	$1,448,384	$995,957	$401,090
	1,361,059	537,326	243,747
	189,835	133,988	53,112
	28,240	169,504	12,920
	107,507	235,409	63,907
	854,599	492,224	367,900
	625,739	1,242,468	804,961
	164,266	205,323	52,271
	100,940	204,976	178,507
	303,829	479,516	285,932
	310,011	370,717	131,529
	288,702	411,473	269,668
	234,407	273,705	196,069
	60,204	107,781	37,721
	77,205	113,974	75,741
lia	47,616	67,383	154,228
\sia	163,401	380,324	73,823
	230,132	278,537	20,496
	361,744	228,654	322,632
	725,378	1,184,945	814,036
l	7,692,198	8,113,945	4,480,290

er manufactures of iron and steel wire [1]*—Domestic exports—Calendar years.*

Exported to—	1918	1919
	Dollars.	*Dollars.*
	211,127	317,504
	390,920	182,046
	59,673	74,677
	35,018	73,225
	108,596	73,809
		3,617
	864,757	746,054
	32,376	38,670
	169,658	274,197
	195,020	312,439
	108,611	300,489
	142,777	403,709
	144,118	144,930
	38,913	108,498
ia	73,276	124,487
sia	122,735	127,681
	108,157	124,833
		5,209
	233,979	346,492
	637,416	1,307,925
	3,677,127	5,090,491

t include woven-wire fencing nor wire rope and cables.

tures of wire—Screen cloth, wholesale, small lots, New York (price per 100 square feet).

[From Hardware Age.[1]]

Date.	12-mesh (painted black).	12-mesh (galvanized).	14-mesh (bronze).
	$1.20	$1.75	$5.00
3	1.20	1.75	5.00
	1.20	1.75	5.00
	1.20	1.75	5.00
5	1.20	1.65	5.25
	1.15	1.65	6.50
	1.50	2.10	7.50
	2.00	2.50	10.00
	2.20	2.60	10.00
	2.20	2.75	10.00
	2.40	2.80	10.00
	2.25	2.85	8.75
9	2.25	2.90	10.25

ns represent prices obtainable by the fair retail hardware trade, and are revised from month

Manufactures of wire — Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of dut and ad va
1883	182	Iron or steel wire, smaller than No. 5 and not smaller than No. 10 wire gauge.	1½ cents per
		Smaller than No. 10 and not smaller than No. 16 wire gauge.	2 cents per p
		Smaller than No. 16 and not smaller than No. 26 wire gauge.	2½ cents per p
		Smaller than No. 26 wire gauge	3 cents per p
		Provided, That iron or steel wire covered with cotton, silk, or other material, and wire commonly known as crinoline, corset, and hat wire shall pay 4 cents per pound in addition to the foregoing rates.	
		And provided further, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made, either wholly or in part.	
		And provided further, That iron or steel wire cloths, and iron or steel wire nettings, made in meshes of any form shall pay duty equal in amount to that imposed on iron or steel wire of the same gauge, and 2 cents per pound in addition thereto.	
		* * * galvanized iron or steel wire (except fence wire) ½ cent per pound in addition to the rate on the wire of which it is made.	
1890	148	Wire made of iron or steel, not smaller than No. 10 wire gauge...	1½ cents per p
		Smaller than No. 10 and not smaller than No. 16 wire gauge..	1¾ cents per p
		Smaller than No. 16 and not smaller than No. 26 wire gauge.	2½ cents per p
		Smaller than No. 26 wire gauge	3 cents per po
		Provided, That iron or steel wire covered with cotton, silk, or other material, and wires or strip steel, commonly known as crinoline wire, corset wire, and hat wire, shall pay a duty of 5 cents per pound.	
		And provided further, That flat steel wire, or sheet steel in strips, * * * twenty-five one-thousandths of an inch thick or thinner. * * *	50 per cent ad v
		And provided further, That no article made from iron or steel wire, or of which iron or steel wire is a component part of chief value, shall pay a less rate of duty than the iron or steel wire from which it is made either wholly or in part.	
		And provided further, That iron or steel wire cloths, and iron or steel wire nettings made in meshes of any form, shall pay a duty equal in amount to that imposed on iron or steel wire used in the manufacture of iron or steel wire cloth, or iron or steel wire nettings, and 2 cents per pound in addition thereto.	
		* * * iron or steel wire coated with zinc or tin, or any other metal except fence wire and iron or steel, flat, with longitudinal ribs, for the manufacture of fencing, one-half of 1 cent per pound in addition to the rate imposed on the wire of which it is made. * * *	
	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or any other metal, and whether partly or wholly manufactured.	45 per cent ad v
1894	124	* * * round iron or steel wire, * * * not smaller than No. 13 wire gauge	1½ cents per po
		Smaller than No. 13 wire gauge, and not smaller than No. 16 wire gauge	1½ cents per po
		Smaller than No. 16 wire gauge	2 cents per pou
		All other iron or steel wire and wire or strip steel commonly known as crinoline wire, corset wire, drill rods, needle wire, piano wire, clock and watch wires, and all steel wires, whether polished or not polished, in coils or straightened, and cut to lengths, drawn cold from rods or bars, and flat wire, flat steel wire, or sheet steel in strips, uncut, cut or covered with cotton, silk, or other material or metal, and all the foregoing manufactures of iron or steel, of whatever degree or form, valued above 4 cents per pound, shall pay a duty of 40 per cent ad valorem.	40 per cent ad v
		Provided, That articles manufactured from iron or steel wire shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture of such articles, and in addition thereto 1 cent per pound.	
	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad v

Manufactures of wire—Rates of duty—Continued.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
137	Round iron or steel wire, not smaller than No. 13 wire gauge.....	1¼ cents per pound.
	Smaller than No. 13 and not smaller than No. 16 wire gauge.	1½ cents per pound.
	Smaller than No. 16 wire gauge.....	2 cents per pound.
	Provided, That all the foregoing valued at more than 4 cents per pound shall pay 40 per cent ad valorem.	
	Iron or steel or other wire not specially provided for in this act, including such as is commonly known as hat wire, or bonnet wire, crinoline wire, corset wire * * * and sheet steel in strips, twenty-five one thousandths of an inch thick or thinner, any of the foregoing, whether uncovered or covered with cotton, silk, metal, or other material, valued at more than 4 cents per pound.	45 per cent ad valorem.
	Provided, That articles manufactured from iron, steel, brass, or copper wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1¼ cents per pound. * * *.	
	Iron or steel wire coated with zinc, tin, or any other metal, two-tenths of 1 cent per pound in addition to the rate imposed on the wire from which it is made.	
193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum or other metal and whether partly or wholly manufactured.	45 per cent ad valorem.
135	Round iron or steel wire, not smaller than No. 13 wire gauge.....	1 cent per pound.
	Smaller than No. 13 and not smaller than No. 16 wire gauge.	1¼ cents per pound.
	Smaller than No. 16 wire gauge.....	1¾ cents per pound.
	Provided, That all the foregoing shall pay duty at not less than 35 per cent ad valorem.	
	All wire composed of iron, steel, or other metal except gold or silver, covered with cotton, silk, or other material * * * and all flat wires * * * and all other wire not specially provided for in this section, shall pay a duty of not less than 35 per cent ad valorem.	
	On iron or steel wire coated by dipping, galvanizing, or similar process with zinc, tin, or other metal, there shall be paid $\frac{1}{10}$ of 1 cent per pound in addition to the rate imposed on the wire of which it is made: *Provided, further*, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles and in addition thereto 1 cent per pound: *Provided, further*, That no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem: * * *.	
199	Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
114	* * * Articles manufactured wholly or in chief value of any wire or wires provided for in this section * * *.	15 per cent ad valorem.
167	Articles or wares not specially provided for in this section; if composed wholly or in part of platinum, gold, or silver, and articles or wares plated with gold or silver, and whether partly or wholly manufactured, if composed wholly or in chief value of iron, steel, lead, copper, brass, nickel, pewter, zinc, aluminum, or other metal, but not plated with gold or silver, and whether partly or wholly manufactured.	50 per cent ad valorem. 20 per cent ad valorem.

ecisions appear in surveys upon wire products.

UNITED STATES TARIFF COMMISSION
WASHINGTON

ARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

ARAGRAPH 118 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

NVILS, BLACKSMITHS' HAMMERS, NIPPERS AND PLIERS

Paragraph 118:
Anvils

Paragraph 122:
Blacksmiths' Hammers, etc.

Paragraph 166:
Nippers and Pliers

REVISED EDITION

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by he United States Tariff Commission and transmitted to the Committee on Ways and Means. The series covers all of the articles nd commodities provided for in the tariff act of October 3, 1913, nd others not specifically provided for. It is arranged in the umerical order of paragraphs of that act.

In some cases two or more paragraphs have been combined in one mphlet. In doing this, industrial relationship of the articles has en followed when possible. In those instances where a paragraph s been treated under a preceding paragraph of the tariff act, ference is made to this fact at the point where the paragraph pears in numerical order. Where one grade of an article is dutiable d another grade of the same article is on the free list, the article discussed under the dutiable paragraph, which appears first in merical order in the tariff act. In certain instances articles of ose industrial relationship and which occur in separate paragraphs the tariff act have been combined under one paragraph for conenience of discussion. Reference is made to this fact at the point here the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," hich contains:

1. An introductory chapter discussing the scope of the series and e general method of treatment.
2. An alphabetical index of the articles provided for in the tariff ct of 1913, showing the paragraph of the act in which the article is rovided for and, if discussed under a different paragraph, the umber of such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs nd articles included in each pamphlet.

Thus by use of this "Introduction and Index," the exact location the discussion relating to a given article or commodity can be scertained.

In the preparation of this report the Tariff Commission had the rvices of P. M. Tyler, Louis A. Rufener, and H. J. Bierman of the etals Division of the Commission's staff, and of others.

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ANVILS.

SUMMARY.

The anvil industry is of small size, the total annual product prob-
ly not exceeding $1,000,000 in value. Ohio, New York, and New
rsey are the leading States.

The chief foreign producing countries are England, Germany, and
veden, and imports from these countries were relatively large before
e war. The maximum imports of anvils were in 1911, when they
mounted to 1,310,863 pounds, valued at $66,771. Imports from
ngland have consisted mainly of the Peter Wright anvils, which
ve such a firmly established reputation in this country that many
acksmiths will use no others if they can obtain anvils of this make.
r a time during the war no Peter Wright anvils could be imported,
t during 1919 and 1920 these anvils have been imported in in-
easing numbers. Swedish cast-steel anvils were imported before
e war because of their cheapness and because the superior quality
the steel from which they were cast made them compare favorably
th the more expensive forged or wrought American anvil. They
ve again appeared on the American market in 1920.

Some anvils were exported in 1918 and 1919.

In 1913 the duty on anvils was reduced from 1⅝ cents per pound,
uivalent to about 31 per cent ad valorem, to 15 per cent ad valo-
m. Since 1913, however, the price of anvils has risen greatly, the
erage value of imports per pound in 1919 and the first three-
arters of the fiscal year 1920 having been $0.147 as compared with
053 in 1913. Consequently the duty of 15 per cent based on this
her value amounted to 2¼ cents per pound.

Summary table.

Fiscal year.	Domestic production.	Imports for consumption.	Ratio to production (imports).	Value of imports for consumption.	Amount of duty.	Value per unit of quantity.	Actual or equivalent ad valorem rate.
	Pounds.	*Pounds.*	*Per cent.*			*Per pound.*	*Per cent.*
[illegible]	.....	1,201,266	.....	$63,906.08	$19,740.15	$0.053	30.89
[illegible]	[1] 2,600,000	1,310,863	50.42	66,771.00	21,301.51	.051	31.95
[illegible]	.....	895,908	.....	45,341.00	14,558.53	.051	32.11
[illegible]	.....	969,427	.....	51,289.00	15,753.26	.053	30.72
[illegible]	.....	727,502	.....	41,338.00	7,771.89	.057	18.80
[illegible]	.....	340,678	.....	20,391.00	3,058.65	.060	15.00
[illegible]	.....	228,895	.....	13,298.00	1,994.70	.059	15.00
[illegible]	.....	187,680	.....	12,815.00	1,922.25	.068	15.00
[illegible]	.....	9,681	.....	946.00	141.90	.098	15.00
[illegible]	.....	21,019	.....	3,043.00	456.45	.145	15.00
[illegible]	.....	10,863	.....	1,161.00	174.15	.107	15.00
[illegible]	.....	88,961	.....	14,458.00	2,168.70	.163	15.00
[illegible]	.....	275,805	.....	33,820.00	5,073.00	.123	15.00

[1] Estimate of leading anvil manufacturers.

[2] Calendar year.

General Information.

1913 TARIFF PARAGRAPH.

PAR. 118. Anvils of iron or steel, or of iron and steel combined, by whatever process made, or in whatever stage of manufacture, 15 per centum ad valorem.

DESCRIPTION.

The ordinary anvil is the blacksmith's anvil, with a cone or horn at one end for shaping rings, hooks, horseshoes, etc., and at the other end the heel, with a socket, called the hardie hole, for a chisel or bottom swage and usually a round hole. The English manufacturers use the term "bick" instead of horn, in speaking of the rounded end of the anvil. Anvils differ in shape according to special uses. For example, the Hay-Budden Manufacturing Co. produces farriers' plain-horn anvils, clip-horn anvils, swelled plain-horn anvils, and swelled clip-horn anvils, plowmakers' anvils, double-horn anvils, hornless anvils, and saw-makers' anvils. A saw-maker's anvil differs radically in shape from an ordinary blacksmith's anvil, being a truncated pyramid with a rectangular base and a flat top.

Anvils vary in size from the tiny article used by jewelers to the enormous anvil blocks of power hammers which weigh several tons. The term "base weight" as applied to American anvils refers to anvils weighing from 80 to 425 pounds, and as applied to English anvils refers to anvils weighing from 80 to 349 pounds. Anvils weighing above or below the base weights cost more per pound than others.

DOMESTIC PRODUCTION.

Materials.—Anvils are made of iron or steel, or of iron and steel combined.

Equipment.—Elaborate plant and equipment is not required in anvil making. Equipment includes power hammers and grinding machines and furnaces for heating the material.

Methods of production.—Methods of production vary according to the kind of anvil made. Some anvils are cast in one piece of iron or steel. The cast-iron anvil is cast onto a steel face which is placed in the bottom of the mold. The Hay-Budden anvil, made in Brooklyn, N. Y., is made in two parts—top and bottom. The top half is forged from one piece of tool steel. The bottom half is forged from selected faggoted scrap iron. The two parts are then welded together, the only weld in this anvil being the one at the waist. The "Trenton" anvil, made by the Columbus Forge & Iron Co., of Columbus, Ohio, is made like the Hay-Budden anvil except that the lower half is made of ingot steel instead of scrap iron. The Peter Wright anvil (English) is made from two solid wrought-iron forgings, top and bottom, made from selected faggoted scrap iron, and the face is heavily steeled with Sheffield steel. This type of anvil has two welds, whereas the Hay-Budden anvil has only one. The forging is done in part by hand labor and in part by power hammers.

Organization.—The anvil industry is necessarily of small size. The number of anvils in use is limited and as each anvil lasts for years there is naturally a comparatively small demand for the product. In

18 there were in the United States four or five anvil manufacturers some importance, and a half dozen or more others who produced ly small quantities. While one or two firms make anvils as their ain product, most of the manufacturers also produce other articles, pecially vises and other forgings.

Geographical distribution.—Of the five producers who are apparently e leaders in the industry, one is in New York, one in New Jersey, d three in Ohio. There are a few smaller manufacturers in Pennlvania, Michigan, and Illinois.

History of the industry.—Prior to the year 1890 wrought or forged vils of iron or steel were not manufactured in this country. All ch anvils used in this country were imported from England or ermany. The American anvil industry is said by manufacturers to ve been developed under the protection of duties provided on vils by the tariff acts of 1890 and 1894.

Domestic production and consumption.—No production statistics are ailable except those presented by the anvil manufacturers at the riff hearings in 1913. The manufacturers estimated production in 07 at 3,000,000 pounds, and in 1911 at 2,600,000 pounds. Imports the former year amounted to 709,749 pounds and in 1911 to 10,863 pounds. Exports were negligible, and we may therefore imate domestic consumption in 1907 at 3,700,000 pounds and in 1 at 3,900,000 pounds, of which in the latter year one-third was ported. During the war years imports declined. Very small antities of anvils were imported in 1918 and 1919 and some were ported.

Domestic exports.—Export statistics are not available. According a leading importer, exports were insignificant before the war, but ring the war exports became more important.

FOREIGN PRODUCTION.

The chief foreign producers are England, Germany, and Sweden. e leading anvil in the world market is the Peter Wright anvil, ade in England. Many of these were imported into the United ates before the war, but during the war years the English export ade was interrupted. During 1919 and 1920 Peter Wright anvils re again imported into this country in increasing numbers. The ength of the position of Swedish anvil manufacturers lies in the perior quality of the steel made from Swedish ores, by means of ich they can make cast-steel anvils which may compete with the ought-iron or wrought-steel anvils of the United States and gland, made with a greater expenditure of labor.

IMPORTS.

Imports during the seven years from 1907 to 1913, inclusive, varied m a minimum of 709,749 pounds in 1907 to a maximum of 10,863 pounds in 1911. During the war years imports fell off til in 1918 they amounted to only 9,681 pounds. In 1919 they creased somewhat to 21,019 pounds, and during the first nine nths of the fiscal year 1920 they rose to 141,645 pounds. The eatest value of imports in any year since 1907 was $66,771 in 1911, d the lowest value was $946 in 1918.

PRICES.

On January 9, 1913, the American "Trenton" anvil was quoted in the Hardware Age at 10 cents per pound and the Peter Wright anvil at 11½ cents per pound. On December 18, 1919, American solid wrought anvils were quoted at 23 and 23½ cents and Peter Wright anvils at 23 cents per pound, base weights.

TARIFF HISTORY.

The tariff act of 1894 imposed a duty of 1¾ cents per pound on anvils. The act of 1897 increased the duty to 1¾ cents per pound. In 1909 the rate was reduced to 1⅝ cents per pound, and in 1913 an ad valorem duty of 15 per cent was substituted for the specific duty.

During the last three fiscal years under the act of 1897 (1907–1909) average annual imports were approximately 783,000 pounds, valued at $47,000, and the average equivalent ad valorem rate of the duty paid was 31 per cent. During the four fiscal years 1910–1913, under the act of 1909, average annual imports were 1,094,000 pounds, valued at $57,000. Because of the lower unit value of these imports the average equivalent ad valorem rate remained 31 per cent as before, although the specific duty was a little lower. In 1914, during the nine months of which the lower duty of 15 per cent ad valorem was in effect, imports were 727,472 pounds, valued at $41,338. From 1914 to 1918 imports steadily declined owing to the war, which prevented normal exports from England and Germany.

COMPETITIVE CONDITIONS.

In the manufacture of wrought or forged anvils labor is the chief item of cost. Both skilled and unskilled labor is employed. The work is of such a nature that the volume of output is closely related to the efficiency of the workmen. The higher rates of wages paid by American manufacturers do not, therefore, represent proportionately higher unit labor costs if the American workman is naturally more efficient than the English, German, or Swedish workman. Nevertheless, the labor costs of the American producer of wrought or forged anvils are substantially higher than those of his European competitors. In the production of cast-iron or cast-steel anvils labor costs represent a smaller part of total costs than in the case of forged or wrought anvils. But the cast-iron anvil is not satisfactory for general use, and the Swedish cast-steel anvil, because of the superior quality of the material used, may compete with the American forged anvil, made with a much greater expenditure of labor. American anvil manufacturers are therefore at a disadvantage as compared with European competitors in general in having higher labor costs, and with Swedish producers in particular in being compelled to match their forged product against the Swedish cast-steel anvil.

Another factor of perhaps even greater importance is the reputation for quality enjoyed by certain foreign makes. Since an anvil, although fairly expensive, may last for a great many years, blacksmiths generally are influenced more by personal preference than original cost. Although many American anvils are guaranteed

; defects, many blacksmiths, who have served their apprentice-
ı an imported anvil, will not work on any other. A member
commission's staff [1] encountered such preference some years
ıile operating in an isolated mining camp in Colorado. The
niths were so strongly in favor of a Peter Wright anvil that he
sed one at a cost of 5 cents a pound more than the price of
erican make. The difference ($10 on a 200-pound anvil) was
ble as compared with the labor involved on two shifts (amount-
$16 per day) in addition to other charges of fully $5 per day
d against the work done on this one anvil.

Anvils—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1¼ cents per pound.	709,749	$43,629.00	$13,307.84	$0.061	30.50
.....	.....do.....	1,015,515	61,435.58	19,040.91	.061	30.99
.....	.....do.....	624,930	36,595.00	11,717.46	.059	32.02
.....	.....do.....	87,828	4,548.00	1,646.77	.052	36.21
.....	1¼ cents per pound.	1,113,438	59,358.00	18,083.38	.053	30.48
.....	.....do.....	1,310,863	66,771.00	21,301.51	.051	31.95
.....	.....do.....	895,908	45,341.00	14,558.53	.051	32.11
.....	.....do.....	969,427	51,289.00	15,753.26	.053	30.72
.....	.....do.....	168,256	8,423.00	2,734.64	.050	32.47
.....	15 per cent ad valorem.	559,216	32,915.00	4,937.25	.059	15.00
.....	.....do.....	340,678	20,391.00	3,058.65	.060	15.00
.....	.....do.....	226,895	13,298.00	1,994.70	.059	15.00
.....	.....do.....	187,680	12,815.00	1,922.25	.068	15.00
.....	.....do.....	9,681	946.00	141.90	.098	15.00
.....	.....do.....	21,019	3,043.00	456.45	.145	15.00
.....	15 per cent.....	10,863	1,161.00	174.15	.107	15.00
.....	.....do.....	88,961	14,458.00	2,168.70	.163	15.00
.....	.....do.....	275,805	33,820.00	5,073.00	.123	15.00

[1] Calendar year.

Anvils—Rates of duty.

ar.	Tariff classification or description.	Rates of duty, specific and ad valorem.
63	Anvils, * * * weighing each 25 pounds or more.....	2 cents per pound.
55	Anvils of iron or steel, or of iron and steel combined, by whatever process made, or in whatever stage of manufacture.	2½ cents per pound.
28	.....do.....	1¼ cents per pound.
42	.....do.....	1½ cents per pound.
40	.....do.....	1¾ cents per pound.
18	.....do.....	15 per centum ad valorem.

Court and Treasury Decisions.

r weights in the shape of anvils, composed of nickel-plated
ere held properly classified under paragraph 199 of the act
as a manufacture of metal rather than as anvils under para-
40, because incapable of practical use as anvils. (Abstract
T. D. 33511.)

[1] Paul M. Tyler.

BLACKSMITHS' HAMMERS, TONGS, AND SLEDGES, TRACK TOOLS, WEDGES, AND CROWBARS.

SUMMARY.

Blacksmiths' hammers, tongs, and sledges, track tools, wedges, and crowbars are simple tools made of forged or cast steel, and weighing from 4 to 20 pounds or more.

Production and export statistics are not available. Imports have been very small compared with the obviously large domestic consumption, having never reached a value of $5,000 in any year since 1907.

Pennsylvania is the leading producing State, but these articles are also manufactured in many other States, including New York, New Jersey, Massachusetts, Ohio, Indiana, Illinois, and Michigan.

It does not appear that in the making of these articles American manufacturers are at a disadvantage compared with their foreign competitors.

The leading foreign producers are England, Germany, Sweden, France, Belgium, and Canada.

The rate of duty under the tariff act of 1913 is 10 per centum ad valorem.

Blacksmiths' hammers, tongs, and sledges, track tools, wedges, and crowbars—Summary table.

Fiscal year—	Imports for consumption.	Value (imports for consumption.	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.
	Pounds.			*Per pound.*	*Per cent.*
1910	24,009	$1,886.20	$333.13	0.078	17.7
1911	19,146	1,539.00	263.41	.080	17.1
1912	23,159	1,992.00	318.45	.086	15.9
1913	28,237	2,441.00	388.28	.086	15.9
1914	23,340	1,661.00	187.43	.071	11.2
1915	14,517	1,030.00	103.00	.071	10.0
1916	7,735	724.00	72.40	.094	10.0
1917	9,394	1,069.00	106.90	.114	10.0
1918	5,337	511.00	51.10	.096	10.0
1919	8,037	655.00	65.50	.082	10.0
1920	.....	3,988.00	398.80	.....	10.0
1918[1]	9,668	751.00	75.10	.078	10.0
1919[1]	2,911	593.00	59.30	.204	10.0
1920[1]	.....	5,318.00	531.80	.....	10.0

[1] Calendar years.
Domestic production statistics not available.

GENERAL INFORMATION.

1913 TARIFF PARAGRAPH.

PAR. 122. Blacksmiths' hammers, tongs, and sledges, track tools, wedges, and crowbars, whether of iron or steel, 10 per centum ad valorem.

DESCRIPTION.

acksmiths' hammers, tongs, and sledges, as well as wedges and bars, are so familiar that they will not be defined here nor their described. Track tools include rail tongs, tie tongs, track or mauls, track punches, track chisels, tamping bars, rail forks, rack wrenches, all of which are simple tools made of forged or teel, and weighing from 4 pounds to 20 pounds or more. Rail- track levels, track gauges, and rail benders are also called track

DOMESTIC PRODUCTION.

terials.—The materials required are iron or steel, generally steel.
uipment.—Equipment required includes power hammers and for forging, annealing furnaces, and grinding machines. Pro- on need not necessarily be on a large scale to insure efficient tion of plant.
thods of production.—Although labor-saving machinery is used, derable hand labor is required. Both skilled and unskilled men are employed. Naturally, the labor cost is higher for d than for cast tools.
anization.—Statistics of production are not available, but the of the various articles included in this survey probably aggre- several millions of dollars annually. Production is distributed g a considerable number of concerns. The Roster of Hardware facturers' Organization for War Service (1918) lists 13 pro- s of blacksmiths' tongs, and 10 producers of sledges and heavy ers. Thomas's Register of American Manufacturers lists 24 rns under the railroad track tools, and 8 concerns with an ated capital of $500,000 or more under crowbars. These us manufacturers generally do not confine their operations to anufacture of only one line, but produce a variety of tools.
graphical distribution.—More manufacturers of these various are located in Pennsylvania than in any other State. New , Connecticut, New Jersey, Massachusetts, Ohio, Indiana, Illi- and Michigan are also well represented in the lists of producers.
mestic production and consumption.—Imports of blacksmiths' ers, tongs, sledges, track tools, etc., have been almost negligible. 1914, and probably prior to that date, domestic production has ded domestic consumption.
mestic exports.—Export statistics are not available, but consider- uantities of these tools were exported during the war.

FOREIGN PRODUCTION.

leading foreign producers are England, Germany, Sweden, e, Belgium, and Canada.

IMPORTS.

ports in 1907 amounted to 48,697 pounds, valued at $4,286. In bsequent year have they reached even this figure. In 1915 they valued at only $1,030 and in 1918 at only $511. In 1919 there slight increase to $655. In the fiscal year 1920 imports rose t to the value for 1907, being valued at $3,988. Imports for the lar year 1920 were $5,318.

PRICES.

Import statistics show that the average value per pound of these tools imported in 1915 was $0.071, and in 1919, $0.082. On account of the variety of tools included in this survey, it is not practicable to present price statistics. Replying to inquiries as to the average increase in the prices of these articles, manufacturers have stated to the Tariff Commission that prices are now (September, 1920) approximately 100 per cent greater than they were in 1914 and that there have been no important changes in the quotations since the armistice. One manufacturer adds that the 1914 prices were too low to allow an adequate profit. Competition among domestic manufacturers apparently keeps down home prices and a growing fraction of the output must be marketed abroad in competition with European tools.

TARIFF HISTORY.

Blacksmiths' hammers and sledges, track tools, wedges, and crowbars were made dutiable by the tariff act of 1883 at 2½ cents per pound; by the act of 1890, at 2¼ cents per pound; by the acts of 1894 and 1897, at 1½ cents per pound; and by the act of 1909, at 1¼ cents per pound. By the act of 1913 blacksmiths' tongs were added to the above list of tools, and the whole group was made dutiable at 10 per cent ad valorem. The various specific duties in effect from 1907 to 1913 amounted to from about 16 per cent to 21 per cent on the average. The 10 per cent rate put into effect by the act of 1913 represented, therefore, a substantial reduction. The effect of this reduction upon imports could not be determined during the years 1914–1919 because of the disturbing influence of the war.

COMPETITIVE CONDITIONS.

Blacksmiths' hammers, tongs, and sledges, track tools, wedges, and crowbars are all heavy tools of simple design. Hammers, sledges, and wedges may be made of cast steel. Tongs and crowbars must be made of a good grade of forged steel in order to withstand the heavy usage to which they are subjected. In the production of such of these tools as are made of cast steel and in the simpler forged tools, raw material constitutes the most important item in cost, but in certain forged tools labor cost is the chief item. In the former case American manufacturers are in a practically impregnable position to meet foreign competition. In the latter case they are at some disadvantage because of the cheaper labor available to their European competitors, but this is partially offset by the greater production by drop forging (machine) made possible by the larger home market in the United States. The small imports during the period from 1907 to 1913 indicate that specific duties then in operation, equivalent, approximately, to from 16 to 21 per cent ad valorem provided ample protection to the American producer. The lower rate of 10 per cent ad valorem put into effect by the act of 1913 was not given a fair trial because of the effect of the war on imports from 1914 to 1919. In 1920 there was a large relative increase in imports, but the absolute amount was too small to have much significance.

ners, tongs, and sledges (blacksmiths'), track tools, wedges, and crowbars, of iron or steel—Imports for consumption—Revenue.

cal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1½ cents per pound.	48,697	$4,286.05	$730.48	$0.088	17.04
.....	.....do.....	18,759	1,644.00	281.41	.088	17.12
.....	.....do.....	15,042	1,073.60	225.65	.071	21.03
.....	.....do.....	2,397	195.00	35.96	.081	18.39
.....	1¾ cents per pound.	21,612	1,691.20	297.17	.078	17.57
.....	.....do.....	19,146	1,539.00	263.41	.080	17.12
.....	.....do.....	23,159	1,992.00	318.45	.086	15.99
.....	.....do.....	28,237	2,441.00	388.28	.086	15.90
.....	.....do.....	4,198	364.00	57.73	.087	15.86
.....	10 per cent.....	19,142	1,297.00	129.70	.067	10.00
.....	.....do.....	14,517	1,030.00	103.00	.071	10.00
.....	.....do.....	7,735	724.00	72.40	.094	10.00
.....	.....do.....	9,394	1,069.00	106.90	.114	10.00
.....	.....do.....	5,337	511.00	51.10	.096	10.00
.....	.....do.....	8,037	655.00	65.50	.082	10.00
.....	.....do.....	.....	3,988.00	398.80	.....	10.00
.....	.....do.....	9,668	751.00	75.10	.078	10.00
.....	.....do.....	2,911	593.00	59.30	.204	10.00
.....	.....do.....	.....	5,318.00	531.80	.....	10.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1902.
[3] July 1 to Oct. 3, 1913, under act of 1909. Tongs not included prior to Oct. 4, 1913.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] Calendar year.

smiths' hammers, tongs, and sledges, track tools, wedges, and crowbars—Rates of duty.

Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
165	Iron or steel blacksmiths' hammers and sledges, track tools, wedges, and crowbars.	2½ cents per pound.
156	Blacksmiths' hammers and sledges, track tools, wedges, and crowbars, whether of iron or steel.	2½ cents per pound.
129	Same as 1890.....	1½ cents per pound.
144	.....do.....	Do.
143	.....do.....	1¾ cents per pound.
122	Blacksmiths' hammers, tongs, and sledges, track tools, wedges, and crowbars, whether of iron or steel.	10 per centum ad valorem.

Court and Treasury Decisions.

eel picks, spike hammers or mauls for driving spikes, used mainly railroad companies in laying and repairing tracks, and clawed were held to be "track tools" and not as manufactures of metal in the act of 1883. (Procter *v.* Spalding, 26 Fed., 610.)

NIPPERS AND PLIERS.

SUMMARY.

Official statistics on production and exports are lacking. The value of nippers, pliers, and pincers produced in 1918 has been authoritatively estimated at from $8,000,000 to $10,000,000. Exports are thought to amount to 2.5 per cent of production, or possibly $200,000 to $250,000 a year. Imports have not been large relatively to production. They were greatest in 1914, when they were valued at $145,000. In no other year since 1910 did they exceed $81,000 in value. After 1914 imports fell off sharply and in 1918 were valued at only $8,960.

The industry is located mainly in New York, Connecticut, New Jersey, and Illinois.

Important foreign producers are Germany, France, Austria, England, Belgium, Sweden, and Japan.

Automatic machinery plays a small part in production, and raw material—steel—represents but a small percentage of total cost of production. Skilled labor represents a major element in costs. The industry is, therefore, one in which relative labor costs in various countries are an important factor in international trade competition.

Nippers and pliers—Summary table.

Fiscal year.	Domestic production.	Imports for consumption.	Domestic exports.	Ratio to production.[1]	
				Imports.	Exports.
		Pounds.		*Per cent.*	*Per cent.*
1910		174,520			
1911		199,862			
1912		140,332			
1913		160,065			
1914	[2] $2,000,000–3,000,000	[3] 17,570			
1918	[2] 8,000,000–10,000,000		[2] $200,000–250,000	0.1	2.5

Fiscal year.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity per pound.	Equivalent ad valorem rate.
1910	$77,406.00	$44,923.98	$0.444	58.05
1911	81,014.50	48,394.78	.405	59.74
1912	67,410.45	38,190.77	.480	56.65
1913	76,343.00	43,342.42	.477	56.77
1914	144,818.38	45,885.30	.....	31.69
1915	69,876.00	20,962.80	.....	30.00
1916	37,024.00	11,107.20	.....	30.00
1917	18,860.00	5,658.00	.....	30.00
1918	8,960.00	2,688.00	.....	30.00
1919	16,739.00	5,021.70	.....	30.00
1918 [4]	10,065.00	3,019.50	.....	30.00
1919 [4]	40,302.00	12,090.60	.....	30.00
1920 [4]	194,145.00	58,333.50	.....	30.00

[1] Percentages based on value.
[2] Estimate of D. G. Smith, of Smith & Hemenway Co., Irvington, N. J. See Domestic production, p. 21.
[3] July 1 to Oct. 3, 1913, only; quantity of imports not specified under the act of 1913.
[4] Calendar year.

General Information.

1913 TARIFF PARAGRAPH.

Par. 166. Nippers and pliers of all kinds wholly or partly manufactured, 30 per cent ad valorem.

DESCRIPTION.

A *plier* is a tool having two lever handles and two cutting or grasping jaws operating on a pivot. Pliers are made in a great variety of forms and sizes for many purposes. They are much used by telegraph and telephone workmen, in railway construction, in manufacturing plants, and by plumbers, farmers, and automobilists. The various types of pliers are named according to their shape or use, as flat nose, round nose, long nose, curved long nose, side cutting, end cutting, insulation cutting, combination, slip-joint, weavers' or duckbill, lineman's, milliners', etc.

A *nipper* is a tool of the plier type, but with jaws meeting only at the ends and used for end cutting only.

A *pincer* is a tool much like the nipper, but designed for grasping rather than for cutting, as for example, carpenters' pincers and farriers' pincers. Under Treasury Decision 30689 pincers are held to be embraced by the clause "nippers and pliers of all kinds as used in the tariff act of 1909." If it is intended so to include pincers, it would be well to designate pincers specifically in the tariff paragraph.

DOMESTIC PRODUCTION.

It is estimated by a representative of American manufacturers that nippers and pliers to the value of from $2,000,000 to $3,000,000 were produced in the United States in 1914, and from $8,000,000 to $10,000,000 in 1918.[1] The abnormal growth indicated by these figures might be accounted for by the extensive use of nippers and pliers for war purposes, and by the rise in prices.

During the war production was largely for war purposes, and commercial stocks were very much depleted.

Materials.—The chief raw material is steel in bars. Nickel also is used for plating, many pliers being nickel plated. The steel used is of domestic manufacture.

Methods of production.—The processes of manufacture in the United States do not differ materially from those used in Europe. Automatic machinery plays only a small part, except in the manufacture of cheap pliers with stamped parts. The machines used in making drop-forged pliers are simple and are the same as have been used for the last 40 or 50 years.[2] There are 26 separate operations requiring handling and skilled labor. The only part made by automatic machinery is the rivet.

The process of manufacture of drop-forged pliers employed in the shops of Kraeuter & Co., of Newark, N. J., is in brief as follows:[3]

Steel bars of the proper size are hammered into the required shape by means of steam hammers and dies. Few drop-forgings are finished

[1] Estimate of D. G. Smith, of Smith & Hemenway Co., Irvington, N. J.
[2] A. A. Kraeuter, Tariff Hearings, Committee on Finance, 1912.
[3] Condensed from an account in the American Machinist Nov. 14, 1918, pp. 889-893.

in one die impression, since by such an operation the die would quickly be worn out of shape, unless the forgings were small and conformed closely to the shape of the bar from which they were made. Dies with several impressions are therefore used by means of which the bar is gradually brought to shape, formed, and finished.

After the forgings have been tumbled and ground to remove burs and rough places they go to the machine room, where the joints are fitted up by milling, filing, and drilling, and the jaw faces are "checked" in various patterns by special milling operations. Next each pair of pliers is individually fitted up by expert workmen, the joint being carefully swaged and filed until each tool is brought into perfect working condition. The joint is then smoothed off on both sides by a grinding machine and the tool is subjected to its first polishing operation. Unless it is a cutting plier, the tool is now ready for the carburizing and hardening process. The cutting plier, before hardening, goes to the edging department, where each pair has its cutting edges brought into shape by hand.

Organization.[1]—Nippers, pliers, and pincers are produced by 28 firms in the United States. About 90 per cent of the factories producing pliers also produce nippers, pincers, or other tools. About 5 per cent of the total output is produced by firms whose principal product is some other article, as, for example, by forge and machine shops. Bradstreet's ratings for the 28 firms is $9,045,000, but equipment, etc., put in during the war would carry this figure much higher.

Geographical distribution.—Of the 28 firms producing nippers, pliers, and pincers, 9 are in New York, 6 in Connecticut, 4 each in New Jersey and Illinois, 3 in Pennsylvania, and 2 in Ohio.

Domestic production and consumption.—The value of domestic production has been estimated at from $2,000,000 to $3,000,000 for 1914 and $8,000,000 to $10,000,000 for 1918.[1]

During the last few years domestic production has exceeded consumption—exports having exceeded imports. From 1910 to 1913, imports in no one year exceeded $81,000, which is only about 4 per cent of the lower limit of the estimated production in 1914 given above. Such importation as has occurred in recent years has been due primarily to the low price at which the foreign article has been offered.

Domestic exports.[1]—Export statistics are lacking, but all classes of nippers, pliers, and pincers have been exported in recent years. It is estimated that 2½ per cent of domestic output is exported. If this estimate is correct and the estimated production $8,000,000 to $10,000,000 is also correct, we would have exports of approximately $200,000 to $250,000 a year. The American product was sold at least as early as 1916 in South American countries and in a small way in Russia and Sweden, and possibly in other countries.

[1] Information supplied by D. G. Smith, of Smith & Hemenway Co. See Domestic production on p. 8

FOREIGN PRODUCTION.

The principal foreign producers are Germany, France, Austria, Belgium, Japan, and Sweden.[1] Germany before the war produced a large of pliers and pincers particularly suited to the export trade.[2] German manufacturers made a close study of the requirements of Australian importers and for many years controlled the entire Australian market for pliers, exporting to that country large quantities of burner, fencing, electricians' cutting, and combination pliers.[3] They did also by far the largest trade in Russia where American tools of this type were too expensive to make much headway,[4] and held a considerable share of the South American trade.[5]

French plier manufacturers before the war also displayed enterprise in competition for foreign markets for their products, having been particularly successful in the export of a line of small pliers, which they sold in South America and in Russia.

England is a large producer and before the war exported to various countries, holding second place in the Russian market.[4]

The Swedish factories of E. A. Berg and F. E. Lindstrom, at Eskilstuna, manufacture a large, popular priced line of nippers, pliers, and pincers which virtually monopolizes the Swedish market. A especially good seller made by these factories is a combination plier extensively used by electricians. Only the highest priced and nickel-plated American pliers were sold in the Swedish market in 1916.[6]

IMPORTS.

Imports for consumption in 1910, the first year for which statistics are available, were 174,520 pounds, valued at $77,406. The greatest imports during the years 1910–1913 inclusive were 199,862 pounds in 1911, valued at $81,015, and the smallest, 140,332 pounds in 1912, valued at $67,410. There was therefore but little variation in imports during that period. In 1914 imports increased substantially, rising to $144,818 in value. After 1914, obviously as a result of war conditions, imports decreased sharply until in 1918 they were valued at only $8,960.

In 1919 the value of imports rose to $16,739, and in the first half of the fiscal year 1920 to $29,467. An examination of the New York Customhouse records showed that more than half of the imports during the six months ending December 31, 1919, came from Sweden. The rest came from Germany, Switzerland, Japan, France, and England. Invoices showed that their imports included side cutting nippers, top cutting nippers, dental pliers, flat pliers, round pliers, and chain pliers. The imports from Japan, valued at $833, consisted wholly of dental pliers.

According to a prominent importer the great bulk of pliers imported before the war came from Germany. Some pliers were imported from England, Sweden, and France. He said all grades of pliers came from Germany, but the best came from Sweden and England. The

[1] See footnote on p. 18.
[2] Department of Commerce, Miscellaneous Series No. 48, p. 14.
[3] Department of Commerce, Miscellaneous Series No. 42, p. 61.
[4] Department of Commerce, Miscellaneous Series No. 46, p. 94.
[5] Department of Commerce, Miscellaneous Series No. 41, p. 96.
[6] Department of Commerce, Miscellaneous Series No. 48, p. 65.

standard English plier is known as the Peter Stub. He added th
before the war English pliers were the most expensive, cost
approximately 25 per cent more than Swedish, 33 per cent more th
French, and 50 per cent to 100 per cent more than German pli
For this reason imports of English pliers were decreasing. Swe
pliers, before the war, he asserted, cost 20 per cent more than sim
American pliers, but they were imported because of their super
cutting edge. At present (May, 1920) Swedish pliers are be
imported in prewar quantities, but prices are up 100 per cent abo
the 1914 level.

The alleged superiority of Swedish pliers is said to be due to t
superior quality of steel from which they are made and to the f
that they are generally hand forged, whereas the best American pli
are generally drop-forged.

A representative of a large manufacturing concern using ma
pliers said that no pliers are made in the United States exactly co
parable with the Swedish diagonal cutting plier, but that one Ame
can firm makes an acceptable substitute.

PRICES.

No strictly comparable wholesale prices are available. But o
page 15 are given descriptions and prices of a number of pliers ma
in various countries as sold in the markets of Australia, Brazil, Chi
Russia and Sweden. Domestic prices of gas-burner and gas-pi
pliers are given on page 22.

The purchasing agent of a concern using many pliers in its plan
said in May, 1920, that importers of Swedish pliers were adjustin
their prices to meet the American market. In January, 192
Swedish pliers were selling in this country at about the same price a
the best American pliers.

TARIFF HISTORY.

Prior to 1909 nippers and pliers were not separately provided for
in the tariff acts. They were dutiable as manufactures of metal. As
such they paid a duty of 45 per cent ad valorem. The same rate wa
retained on such manufactures in 1890, but in 1894 the rate wa
reduced to 35 per cent. In 1897 the rate was increased again to 45
per cent. In 1909 nippers and pliers were enumerated in paragraph
198 and made dutiable at 8 cents per pound and 40 per cent ad
valorem. In 1913 the rate was reduced to 30 per cent ad valorem.

Import statistics are available only since 1910. Under the duties
of the act of 1909 imports ranged in value from $67,410 in 1912 to
$81,015 in 1911. The average computed ad valorem rate of duty
under the act of 1909 varied from 60.63 per cent in 1910 to 56.65 per
cent in 1912. In 1914 under the lower duty of 30 per cent provided
by the act of 1913, imports increased, amounting to $134,476 in the
nine months (Oct. 4, 1913, to June 30, 1914) of the fiscal year 1914,
during which the new law was in operation, or at a rate more than
twice as great as during any year under the act of 1909, but still
almost negligible as compared with the estimated domestic produc-
tion. After 1914, however, imports fell off rapidly, amounting in
the four years, 1915–1918, to less than the amount imported in 1914
alone.

COMPETITIVE CONDITIONS.

In the manufacture of drop-forged nippers, pliers, and pincers, labor ...sts are relatively important and raw material costs relatively unim... ...rtant. Labor-saving machinery is used, but the operations are not ...tomatic, many of them requiring handling by skilled mechanics. ...e steel used in making an ordinary drop-forged 8-inch plier ...presents less than 10 per cent of the total cost of the tool. There ..., however, cheap pliers produced in the United States in which ...mped parts have been substituted for drop-forged parts. In the ...oduction of such pliers more use is made of labor-saving machinery ...d labor costs are much reduced; such pliers have been retailed in ...e United States at 10 cents.

Important foreign producers before the war were Germany, France, ...stria, Sweden, England, Belgium, and Japan. Germany was the ...st important foreign competitor in the American market—the ...lk of imported pliers having come from that country. Pliers ...ported from Sweden, England, and France were imported because their superior quality rather than because of cheapness.

Import statistics are available only since 1910. In all years since ...10 imports have been small compared with domestic production, ...ving been greatest in 1914, when they were valued at $144,818. ...uring the war they decreased steadily until in 1918 they were valued ...only $8,960. Since the end of the fiscal year 1918 they have shown ...me increase but are still below the prewar level.

At present (May, 1920) imports from Sweden are about equal to ...ewar imports from that country, but Germany, from whom most ...our prewar imports came, is not yet in a position to enter our ...arket on the prewar scale. German manufacturers are seriously ...ndicapped by lack of raw material and fuel. Two importers who ...vestigated industrial conditions in Germany in the early part of ...20 agreed in saying that Germany would be in no position to export ...iers to the United States for two years or more.

American producers benefited from war conditions, increasing their ...ports, introducing their product into new markets, and reaping ...normal profits from the rise in prices. They may therefore be ...nsidered to be in a stronger position in respect to international ...de competition than they were before the war.

Nippers and pliers—Production in United States.

[Figures from D. G. Smith, of Smith & Hemenway, Irvington, N. J.][1]

	Value.
.....	$2,000,000 to $3,000,000
.....	8,000,000 to 10,000,000

[1] returns on a questionnaire sent to L. E. Fichthorn, of Peck, Stow & Wilcox, who was delegate for ...pper and plier industry in the Hardware Manufacturers' Organization for War Service.

Nippers and pliers of all kinds wholly or partly manufactured—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ad...
		Pounds.				*Per*
1910	8 cents per pound and 40 per cent.	174,519.75	$77,406.00	$44,923.98	$0.443	
1911[1]	....do	199,862.25	81,014.50	48,394.78	.405	
1912	....do	140,332.38	67,410.45	38,190.77	.48	
1913	....do	160,065.26	76,343.00	43,342.42	.477	
1914	....do	[2] 17,569.75	10,342.88	5,542.73	.589	
1914	30 per cent		134,475.50	40,342.65		
1915	....do		69,876.00	20,962.80		
1916	....do		37,024.00	11,107.20		
1917	....do		18,980.00	5,658.00		
1918	....do		8,940.00	2,688.00		
1919	....do	[3] 44,429.00	[3] 6,739.00	5,021.70	.377	
1918[4]	....do		10,065.00	3,019.50		
1919[4]	....do	[3] 100,103.00	40,302.00	12,090.60	.403	
1920[4]	....do		194,445.00	58,333.50		

[1] Not separately stated prior to 1910.
[2] July 1 to Oct. 3, 1913. Quantity not specified after Oct. 3, 1913.
[3] Number.
[4] Calendar year.

Nippers and pliers—Prices wholesale, small lots, New York.

[Data from Hardware Age.][1]

Date.	Gas burner, 6-inch.	Gas pipe, 7-inch.	Date.	Gas burner, 6-inch.	Gas...
	Per dozen.	*Per dozen.*		*Per dozen.*	*Per*
Jan. 9, 1913	$1.45–$1.50	$2.00	Jan. 9, 1917	$2.90	
July 10, 1913	1.45– 1.50	2.00	July 5, 1917	3.38	
Jan. 9, 1914	1.45– 1.50	2.00	Jan. 3, 1918	3.38	
July 9, 1914	1.45– 1.50	2.00	July 4, 1918	3.38	
Jan. 14, 1915	1.45– 1.50	2.00	Jan. 16, 1919	4.34	
Jan. 6, 1916	1.85– 1.90	2.30	July 3, 1919	4.34	
July 6, 1916	2.80	3.40	Dec. 24, 1919	5.40	

[1] Quotations represent prices obtainable by the fair retail hardware trade.

Nippers and pliers—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, and ad valo...
Year.	Par.		
1883	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, * * * or any other metal, and whether partly or wholly manufactured.	45 per cent ad...
1890	215	....do	Do.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad...
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad...
1909	198	Nippers and pliers of all kinds (except blacksmiths' tongs, surgical and dental instruments or parts thereof), wholly or partly manufactured.	8 cents per po... 40 per cent lorem.
1913	166	Nippers and pliers of all kinds, wholly or partly manufactured...	30 per cent ad...

COURT AND TREASURY DECISIONS.

Surgical forceps are not nippers or pliers within paragraph 166 of the act of 1913 because of having two lever handles working on a pivot and operating two cutting, gripping, or pinching jaws or blades. (Koch *v.* United States, 6 Ct. Cust. Appls., 534; United States *v.* Interocean Forwarding Co., 8 Ct. Cust. Appls., 155.) They were held dutiable as manufactures of metal under paragraph 167.

Weaver's nippers are within paragraph 165, which is not limited to instruments having two lever handles or duplex parts working on a pivot, but includes other instruments commonly and commercially known as nippers and pliers. (T. D. 38121 of 1919.)

Dental forceps (G. A. 7907, T. D. 36404), dental tweezers riveted together at one end and not having two lever handles working on a pivot (T. D. 36012), and curling irons (G. A. 7879, T. D. 36272; Broomingdale *v.* United States, 8 Ct. Cust. Appls., 314) were also excluded from paragraph 166. Pincers, however, are within that paragraph (G. A. 7037, T. D. 30689), as are also nail or manicure nippers (T. D. 33094), but not wrenches or spanners, jaw tools (Abstract 23984, T. D. 30944).

Jeweler's tweezers, composed entirely of metal, being neither nippers nor pliers within the common understanding of those terms, are dutiable as a manufacture of metal under paragraph 167 rather than as nippers or pliers under paragraph 166. (G. A. 8097, T. D. 37357.)

Pincers and pliers were classified as manufactures of metal before specific provision was made for them in 1909 (G. A. 23, T. D. 10245).

Nippers and pliers are dutiable at 30 per cent under paragraph 166; surgical and jeweler's tweezers at 20 per cent under paragraph 167.

○

UNITED STATES TARIFF COMMISSION
WASHINGTON

ARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 119, 120, 121, and 122 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

AUTOMOBILES, BICYCLES, MOTOR CYCLES, AND AXLES

Paragraph 119:
Automobiles and Parts
Paragraph 120:
Bicycles and Motor Cycles
Paragraph 121:
Axles (General)
Special Axles
Paragraph 122:
Blacksmiths' Hammers, etc. (See Par. 118)

REVISED EDITION

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by e United States Tariff Commission and transmitted to the Com- ttee on Ways and Means. The series covers all of the articles and mmodities provided for in the tariff act of October 3, 1913, and hers not specifically provided for. It is arranged in the numerical der of paragraphs of that act.

In some cases two or more paragraphs have been combined in one mphlet. In doing this, industrial relationship of the articles has en followed when possible. In those instances where a paragraph s been treated under a preceding paragraph of the tariff act, refer- ce is made to this fact at the point where the paragraph appears numerical order. Where one grade of an article is dutiable and other grade of the same article is on the free list, the article is scussed under the dutiable paragraph, which appears first in merical order in the tariff act. In certain instances articles of ose industrial relationship and which occur in separate paragraphs the tariff act have been combined under one paragraph for con- nience of discussion. Reference is made to this fact at the point here the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," hich contains:

1. An introductory chapter discussing the scope of the series and e general method of treatment.
2. An alphabetical index of the articles provided for in the tariff t of 1913, showing the paragraph of the act in which the article is ovided for and, if discussed under a different paragraph, the number such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs d articles included in each pamphlet.

Thus by use of this "Introduction and Index" the exact location the discussion relating to a given article or commodity can be certained.

In the preparation of this report the Tariff Commission had the rvices of H. S. DeMeritt and Walter Graham, of the Metals Divi- n of the Commission's staff, and of others.

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BLACKSMITHS' HAMMERS, ETC.

[See par. 118.]

AUTOMOBILES AND PARTS.

SUMMARY.

The automobile industry in 1914 ranked eighth among the manufacturing industries of the United States in value of products, having increased faster during the preceding five years than any other leading industry, the capital invested in manufacture being $407,729,913 and the value of the products, $458,957,843. In 1920 the capital was estimated at $2,126,717,377 and the value of products $2,958,-004,620.[1] About three-fourths of the production is in the State of Michigan, and most of the remainder in four adjoining States. About 87 per cent of the automobiles of the world are owned in the United States, which is also the greatest exporting nation of the world.

Imports are insignificant, in the fiscal year 1914 being about one-third of 1 per cent of the production, and in 1920 about eleven one-hundredths of 1 per cent.

Before the war France was the principal source of import, followed in rank by England, Italy, and Germany. At present Great Britain, France, and Germany are the principal sources of import of the more expensive cars, averaging about $2,500 to $3,500 invoice value each, and a number of low-priced cars are brought from Canada.

Automobiles are now made in America probably equal in quality to those of any European nation, and the lower priced cars are generally superior in quality to the cheaper foreign cars.

The American producer has no natural advantage over his competitors, and wages are higher in America, but he has shown more ability to organize and produce on a very large scale, and so reduce costs. He has also the advantage of a very large domestic market, and has developed a high degree of engineering and mechanical skill. Until recently European cars were built chiefly of high power and of expensive construction, but a tendency is now developing to turn to small low-power cars, which, however, lack the ability to travel over the more difficult roads found outside of Europe, and, moreover, the price of this class of cars has not yet been reduced to a point commensurate with that of cars of American manufacture of a somewhat similar design. The duty under the act of 1913 is 45 per cent on cars of $2,000 or more in value, and 30 per cent on cars of less than $2,000 in value. The manufacturers are not concerned about foreign competition, but rather favor a reduction on account of the influence it might have on possible foreign reciprocal measures, which might open to them opportunities for further European trade.

[1] Compilation by National Automobile Chamber of Commerce.

Automobiles and parts—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption (finished cars).	Domestic exports.	Ratio to production.	
				Imports.	Exports.
		Number.		*Per cent.*	*Per cent.*
1910	$225,000,000	1,305	$11,190,229		
1911	202,500,000	792	15,309,229	0.4	
1912	378,000,000	872	28,435,292	.2	
1913	425,000,000	708	32,982,128	.2	
1914	458,957,843	281	34,591,602	.1	
1915	691,778,950	258	69,510,152	.07	
1916	954,969,353	185	122,633,710	.02	
1917	1,274,488,449	115	121,194,968	.03	
1918		62	114,266,088	.05	
1918[1]	1,236,106,917	75	100,898,969	.007	
1919[1]	1,885,112,548	115	156,426,491	.02	
1920[1]	2,232,927,628	994	363,261,571	.11	

Fiscal year.	Value (imports for consumption).	Amount of duty.	Value per unit of quantity (finished cars).	Ad val
				Per
1910	$3,758,412.75	$1,690,322.73	$2,635	
1911	2,026,888.00	910,345.04	2,705	
1912	2,199,567.00	989,805.15	2,179	
1913	1,934,728.00	870,623.35	2,345	
1914	1,354,953.00	482,786.55	2,103	
1915	1,188,024.00	381,449.10	1,460	
1916	670,721.00	227,184.75	1,445	
1917	436,540.00	150,321.60	1,579	
1918	163,894.00	34,153.10	1,146	
1918[1]	80,695.00	25,788.00	392	
1919[1]	394,693.00	136,923.85	974	
1920[1]	2,132,737.00	696,617.85	1,603	

[1] Calendar years.

GENERAL INFORMATION.

Paragraph 119, act of October 3, 1913: "Automobiles, valued $2,000 or more, and automobile bodies, 45 per cent ad valorem; automobiles valued at less than $2,000, 30 per cent ad valorem; automobile chassis, and finished parts of automobiles, not including tires, 30 per cent ad valorem."

DESCRIPTION.

Automobiles may be divided into two general classes, passenger and commercial. Passenger cars vary widely in quality of workmanship, substantiality of design, luxuriousness, and consequently in price. A compilation by the "Motor List" as of January, 1918, shows 4 per cent of the registered cars were of models retailing at less than $500 each, 46 per cent from $500 to $2,000, and 7 per cent at $2,000 each, and up.

DOMESTIC PRODUCTION.

The census report of 1914 shows the automobile industry eighth in rank in value of product among the manufactures of the United States, the percentage increase in five years being 160, or over two the increase of any of the other leading industries in the same period. The capital invested in the manufacture of automobiles was in 1921, $2,126,717,377,[1] and the wholesale value of complete

[1] From National Automobile Chamber of Commerce "Facts and Figures," May, 1921, and information from War Industries Board.

rs in the year 1920, $2,232,927,628.[1] The rapid growth of the mmercial car business is of comparatively recent date; in 1911 it ounted to about 9 per cent of the total output in value, in 1914 was slightly under 10 per cent, from then on it has been from 17 20 per cent of all production in value. The great increase in the ative proportion of commercial cars in 1918 was chiefly due to the ge production of trucks for military purposes, amounting to over e-quarter of the whole industry, and to the curtailed production pleasure cars.

Materials.—The principal materials used are iron, steel (including veral of its alloys, as vanadium, chromium, nickel, and manganese), ss, aluminum, wood, rubber and rubber fabric, and leather and its bstitutes. To a lesser extent a great variety of materials are ployed, as paints and varnish, hair, copper, insulating materials, ss, celluloid, lead, tin, antimony, etc. The materials are all ob- ned from domestic sources excepting the rubber, and the greater rt of the tin, manganese, and antimony.[2] Balls and ball bearings also imported, formerly coming mostly from Germany, but now most entirely from Norway and Sweden. Imports of balls and arings in 1920 amounted to $1,946,087, the greater part of which used in the manufacture of automobiles.

Equipment.—The equipment employed consists of forge shops, achine shops, comprising automatic and nonautomatic machine ls and special machines, sheet-metal working machines, wood- rking machinery, etc., all of which is of domestic manufacture, d which can be produced of superior quality and at not greater st than abroad. Several of the foreign motor-car manufacturers ve employed American machinery extensively in their shops.

Methods of production.—In this country the use of power machinery d specialization has been carried to a very high degree, made sible by the immense scale on which the industry is carried on, ich in turn is due to the very large market afforded by the large pulation of moderate and large means. In Europe the higher ced cars are to a much larger degree finished by hand and non- cialized machinery, while the lower priced cars as a rule are siderably below the American cars in mechanical excellence. ere is evidence, however, that the manufacturers of France, gland, and Italy are studying American methods with a view to re effective competition.

Organization.—In January, 1919, commercial trucks alone were ng sold under more than 200 different brand names. The census ort of 1914 shows complete automobiles to have been manu- tured in 300 establishments, of which 70, producing to the value $1,000,000 per year or more, turned out 91 per cent of the value products. The high standards and prevailing prices obtaining uld not be possible without large-scale production and large pitalization, amounting in March, 1918, to $736,000,000,[3] and in 20 to $2,126,717,377.[4] There is required either a high degree of gineering and mechanical skill, as for the production of relatively all numbers of high priced cars or a very large organization for quantity production" of those of medium and low price. In the

[1] From National Automobile Chamber of Commerce, "Facts and Figures," May, 1921, and information War Industries Board.
[2] See "Miscellaneous."
[3] See "Miscellaneous," infra.

past six or seven years about 700 firms which had entered the mobile field found themselves unable to continue business th lack of financial resources or for other reasons and failed or r from business. A tendency to amalgamation has recently d oped, the General Motors Corporation, with an authorized capi $1,300,000,000, having absorbed eight prominent concerns. considerable extent the industry is specialized, many of the produced being entirely "assembled"; that is, all the comp parts are bought from firms manufacturing one or more which are then assembled into a complete machine and sold b assembler.

The electric equipment is almost universally purchased specialists, the carbureter to a large extent, and in many cas engines, clutches, transmission gearing, springs, etc. The Ford Co. is the most notable example of a concern making its prod all details, except tires, in its own factories, although other concerns make a considerable fraction of their own component

Geographical distribution.—In 1914 nearly three-fourths in of the production was in the State of Michigan, while 89 per ce in the four States of Michigan, Ohio, Indiana, and Wisconsin. York, Massachusetts, Illinois, Pennsylvania, New Jersey, and necticut were also producers to the extent of $8,000,000 or more

History.—The automobile industry is first mentioned in the in 1899, at which time it was largely in an experimental stage. industry developed earlier in Europe than in America, and early years imported cars were considered superior to the do makes, but at present the American makes are probably the of or superior to any made abroad.

Domestic production and consumption.—The domestic produc greater than the domestic consumption, foreign competition almost ceased. In 1916 the exports were about one-eighth production, declining during the war to about 9 per cent.

Domestic exports.—Exports for the year 1916, the last year America entered the war, were $122,633,710, amounting to 13 per cent of the domestic production. In 1918 they had d to $114,266,088, or about 9 per cent of the production, but i had increased to $298,219,875, a gain of 13 per cent of prod In the fiscal year 1914, previous to the European war, and 1918, roughly, one-quarter of the exports went to Canada an quarter to the United Kingdom. In 1914 France took only a per cent, while in 1918, due to war needs, she took about cent. The remaining one-half of the exports have gone chi Argentina, Australia, New Zealand, Cuba, Japan, South Afric the countries of South America.

FOREIGN PRODUCTION.

The principal foreign producing nations are France, En Italy, Germany, and Belgium. While there is practically n petition by these countries in the American market, they before the war active competitors for the trade of the rest world. In 1913, American exports were about $33,000,000, France exported about $45,000,000 and England and G approximately $17,000,000 each. During the period from 1916 the exports of America increased greatly, to $122,633,71

of this increase being in the form of trucks required for military
oses by England and France, while the exports of England
ined to about $11,000,000, Italy remained at $17,000,000, and
trade of Germany ceased entirely.
anadian production of automobiles and accessories was, in 1917,
962,141,[1] being the output of 11 factories with a total capital of
192,858. Great Britain, France, and Italy are now considering
ing degrees of import restrictions, in some cases of a temporary
ire only. A deputation of English manufacturers which waited
he president of the British Board of Trade in the latter part of
), requested a duty of 33⅓ per cent on commercial vehicles, but
opinion of the board was that adverse exchange, freight, packing,
insurance charges protected this class of vehicles to the extent
5 per cent, and that the same factors in addition to the existing
ff of 33⅓ per cent amounted in the case of passenger cars to 88
cent. Belgium had, before the war, 13 automobile factories
ch in 1912 produced about 5,500 cars, as compared with about
,000 made in the United States in the same year. A large part
he prewar output of Belgium was exported, chiefly to South
erica, Great Britain, Germany, and Holland. During the war,
t of the Belgian factories were destroyed or denuded of machin-
, but nearly all of these have now resumed production, and many
hem expect to approach their prewar output during 1920. Several
he Belgian cars are of high class and widely known, such as the
tallurgique, Minerva, and Fabrique Nationale.[2]
rior to the war, English imports and exports were of nearly
al volume, the imports coming from the United States, France,
Belgium, the exports going to her colonies. During the war,
orts averaged from two to three times the exports; the United
tes had practically a monopoly of the import trade. There has
n comparatively little British reexport. The British industry is
behind the American in organization and capacity, but English
nufacturers are apparently awake to the lessons which they may
rn from America in this respect.
French manufacturers have up to the present specialized in the
her and moderate priced cars, and have not as yet produced a
-priced car as such is understood in America.
Canada is assuming a position of importance and many American
ns have established Canadian branches. A considerable Canadian
ort business has also been established, chiefly with Australia and
w Zealand, which take over half of the whole, and with South
erica and South Africa.
Japan has granted a bounty to manufacturers of trucks which
et certain specifications qualifying them for military uses.
n Germany [3] before the war, there were 38 automobile factories,
ich supplied nearly all the domestic demand, as well as a large
ort trade, Russia being the largest customer. A considerable
de was also carried on with Austria, England, and South America.
ring the war, passenger-car construction stopped entirely, and
ctically all the cars then existing have been either used up or
l neutral countries. Truck production was pushed to the utmost,
the greater part of these were lost when Germany was defeated,

[1] Automotor Journal, Engl., Jan. 17, 1919.
[2] Commerce Reports, Jan. 15, 1920.
[3] Report on German Automobile Industry, by American vice consul at Lucerne, Mar. 1, 1919.

and those that remain are very inferior, due to lack of proper materials and to hard usage. German manufacturers are now posing to study and adopt American methods and organization.

The automobile has been regarded in Europe as a luxury to a greater degree than in this country. The foreign output has mostly of expensive high-power cars, the expense of which has and is now to a still greater degree, added to by taxes on cars, line, and operation, and by the high price of fuel. European facturers are now turning to the building of small low-power which, though economical of fuel and well adapted to the Europe, are not suitable in the designs thus far brought out to more difficult traveling conditions met with elsewhere, and they not yet been successful in reducing their costs to those of Amer machines of equal or greater capabilities.

While little is to be expected in the way of competition in United States, foreign manufacturers in general are apparently paring to make efforts to regain their lost ground in the export t and in the supply of their own countries.

IMPORTS.

The import of automobiles has declined in every year from 1 when it reached a maximum, to 1918. In the year 1913, before European war, it was equal only to about one-third of 1 per ce the domestic production, and in 1918 to less than one one-hundred 1 per cent. Since 1918 imports have increased rapidly, and in amounted to over $2,000,000, even this figure being, however, about one-tenth of 1 per cent of the estimated production for year. Before the war the principal sources of imports were Fra which furnished about half, and Great Britain, Germany, and It Since the war Canada has also been an important contributor, in furnishing three-fourths of the cars imported. This was less half the value of all imported cars, owing to the low prices of Canadian cars. In 1920 the value of parts exceeded that of plete cars; the greater portion of the imported parts were of Br origin.

In 1920 the average value of cars imported from Great Britain about $3,600, French and German cars averaged $2,600, and Cana cars less than $700.

PRICES.

Prices can not be considered as strictly comparable, owin differences in design and quality of workmanship, regarding w there may be great differences in individual opinion, but in ge the price of high-quality American cars is lower than that o European car of the same character. In the case of the medium low-priced cars, the American make will in almost every cas found not only of a lower price but of considerably greater po Cars of 10 to 12 horsepower, the rule among low-priced cars of fo make, are almost unknown in this country, as they would be im ticable for American road conditions.

The chassis of the Pierce Arrow and the Packard, American n representing the highest standards of manufacture, of about 45 h power each, and now (1919) selling f. o. b. manufacturers' wor $6,450 and $4,850, respectively, may be compared with chas

Italian Isotta-Fraschini, the English Rolls-Royce, and the French Launay-Belleville, sold at $10,000, $7,500, and $7,400, respectively, and about the same power. The American Cadillac and ...nton, of 31 and 48 horsepower, respectively, and sold at $3,490 ... $4,350, compare in a general way with the English Sunbeam, ...ssley, and Wolsely of considerably lower power at prices ranging ...n $4,375 to $5,500. For further comparisons, reference is made ...table on page 39.

The tabulation of prices on page 21 will be seen to show in general ...radual reduction in price until 1917. This reduction was due in ...st cases to decreased cost resulting from greatly increased pro...ction, though some very radical reductions were due in part to ...anges in design. These reductions are the more noteworthy in ...t they continue through 1916 and 1917, when the price of steel ...d other materials and of labor was rapidly increasing. In 1918, ... increased cost of material and labor forced advances which con...ued through 1919, and amounted in general to between 50 and 75 ... cent over the levels of 1917.

TARIFF HISTORY.

Prior to 1909 automobiles were classed as manufactures in chief ...lue of metal, not specially provided for, on which the duty was 45 ... cent ad valorem. In the law of 1909 automobiles were first ...ecifically mentioned and were made dutiable at 45 per cent ad ...lorem.

In the act of 1913 this duty was continued on bodies and cars ...lued at $2,000 or more, but that on chassis, finished parts, and ...s valued at less than $2,000 was reduced to 30 per cent.

COMPETITIVE CONDITIONS.

America is as favorably situated in regard to raw materials as her ...mpetitors, and owing to the high development of the industry in ...nerica, which has permitted the reduction of manufacturing costs, ...twithstanding the fact that wages are somewhat lower in Europe, ...ere is practically no competition in the American market by ...reign manufacturers at the present time.

The cost of labor in relation to total cost varies greatly with the ...pe of machine, being larger in the case of high-priced cars than for ...w-priced cars which are produced in the very large quantities.

TARIFF CONSIDERATIONS.

The commanding position of the American industry in the do...estic market and the almost negligible importation direct attention ...ore to the possible effect of the American tariff on the export trade ... this country than to its bearing on foreign competition with ...omestic manufacture. In 1908 the Ford Motor Co. joined with the ...nporters in opposing the petition of a number of American manu...cturers for an increase in the tariff, claiming that the rate then in ...fect, 45 per cent ad valorem, was too high since the labor cost was ...small item.

At the hearings in 1913 [1] it was claimed by the importers, who ...esented data in support, that greater productivity in the factories

[1] Tariff hearings, Committee on Ways and Means, 62d Cong., 3d sess., 1913, p. 1280.

of the United States more than offset the higher wages paid, and that the actual labor cost in Great Britain and Germany was higher than in America. At the same hearings [1] a committee representing 13 American manufacturers, chiefly of high-priced cars, claimed that while the labor cost in cheap cars was a small item, in the more expensive cars it is a considerably larger factor, presenting figures intended to show that while in the Ford car, selling for $690, labor was 13 per cent; in the Packard car, selling for $4,200 it amounted to 31 per cent; and that European labor was employed under as productive conditions as American.

The New York Transportation Co. and the Fifth Avenue Coach Co., users of large passenger-carrying vehicles, claimed [2] that no chassis was produced in America suitable for this class of work.

The National Automobile Chamber of Commerce, representing about 125 automobile manufacturers of all classes, including the higher priced cars, now (1920) states that the industry is unanimously in favor of a reduction in the duty on cars of over $2,000 in value, in order to prevent retaliation by foreign countries and consequent loss of export business.

Considering the immense productive capacity of the industry, and the present numerical relation of automobiles to population in the United States, nearly one to fourteen,[3] it would appear that domestic production could not long continue increasing at the rate of recent years, and that manufacturers will need to look to export trade to provide an outlet for a portion of their production. A syndicate of French manufacturers recently represented to the French ministry that the English, Belgian, Italian, and French syndicates had collectively voted for a tariff of 33⅓ per cent on all cars.[4] The French ministry, however, cited the United States tariff of 45 per cent on cars of over $2,000 in value, and fixed the French tariff at that figure, adding that a further reduction may follow, if the American tariff should later be lowered.

Automobiles, complete [5]*—Production in United States.*

[From Federal Census.]

States.	1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Michigan	9,125	$6,552,804	64,800	$70,359,749	443,072	$[illegible]
Ohio	2,808	5,197,360	14,299	23,550,112	67,483	[illegible]
New York	1,808	3,071,093	8,064	17,509,582	11,936	[illegible]
Indiana	1,020	1,428,463	17,253	17,604,936	15,448	[illegible]
Wisconsin	2,390	1,856,694	5,501	7,085,562	10,030	[illegible]
Massachusetts	2,365	2,052,943	3,466	6,229,438	7,278	[illegible]
All other	2,176	3,391,877	13,120	21,929,945	14,697	[illegible]
Total	21,692	23,751,234	126,503	164,269,324	569,054	[illegible]

[1] Hearings before Committee on Finance, U. S. Senate, H. R. 18642, 62d Cong., 2d sess., p. 437.
[2] Tariff hearings, Committee on Ways and Means, 62d Cong., 3d sess., 1913, p. 1289.
[3] In May (1920) issue of Motor Howard Greene states that there are, in round numbers, [illegible] motor vehicles in use in United States at present time.
[4] Review of American Chamber of Commerce in France, Jan. 1, 1920, p. 22.
[5] The production of automobile parts is disregarded, since these parts are used in largest measure by the manufacturers of complete machines.

Automobiles, passenger—Production in United States.

[From Federal Census.]

States.	1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
n	9,023	$6,481,164	63,883	$68,756,909	437,083	$295,553,172
	2,807	5,192,360	13,493	22,630,862	58,548	53,835,446
	989	1,386,003	17,081	17,210,854	14,968	19,592,316
rk	1,539	2,239,136	7,044	15,316,686	7,774	13,745,983
r	5,903	6,352,668	20,367	31,906,020	25,306	31,132,462
otal	20,261	21,651,331	121,868	155,821,331	543,679	413,859,379

Automobiles, commercial—Production in United States.

[From Federal Census.]

States.	1904		1909		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	1	$5,000	806	$919,250	8,935	$15,629,924
in	102	71,640	917	1,602,840	5,989	8,221,082
ork	269	831,957	1,020	2,192,896	3,282	8,013,134
lvania	5	13,300	369	729,351	2,139	3,879,848
er	1,054	1,178,006	1,613	3,003,656	5,030	9,354,476
otal	1,431	2,099,903	4,725	8,447,993	25,375	45,098,464

Passenger cars and commercial trucks—Production in United States.

[From National Automobile Chamber of Commerce, 1921.]

Year.	Quantity.	Value, wholesale.	Year.	Quantity.	Value, wholesale.
	210,000	$262,500,000	1916	1,583,617	$954,969,353
	378,000	378,000,000	1917[2]	1,868,947	1,274,488,449
	485,000	425,000,000	1918[2]	1,153,637	1,236,106,917
	569,045	458,957,843	1919	1,974,016	1,885,112,546
	892,618	691,778,950	1920	2,205,197	2,232,927,628

ures from U. S. census report.
ures stated to have been obtained from War Industries Board. Sources of information for other s said to be based on sworn statements of the members of the National Automobile Chamber of erce.

Automobiles, passenger—Production in United States.

[From National Automobile Chamber of Commerce, 1921.]

Year.	Quantity.	Value, wholesale.	Year.	Quantity.	Value, wholesale.
	181,000	$213,000,000	1916	1,493,617	$797,469,353
	199,319	240,770,000	1917[2]	1,740,792	1,053,505,781
	356,000	335,000,000	1918[2]	926,388	801,937,925
	461,500	399,902,000	1919	1,657,652	1,461,785,925
	543,679	413,859,379	1920	1,883,158	1,809,170,963
	818,618	565,978,950			

ures from U. S. census report.
ures stated to have been obtained from War Industries Board. Other figures from sworn statements National Automobile Chamber of Commerce.

Automobiles, commercial—Production in United States.

[From Automobile Chamber of Commerce, 1921.]

Year.	Quantity.	Value, wholesale.	Year.	Quantity.	Va...
1911	10,655	$22,292,321	1916	90,000	$15...
1912	22,000	43,000,000	1917 [2]	128,157	22...
1913	23,500	44,000,000	1918 [2]	227,250	40...
1914 [1]	25,375	45,088,464	1919	316,364	43...
1915	74,000	125,800,000	1920	322,039	43...

[1] Figures from U. S. census report.
[2] Figures stated to have been obtained from War Industries Board. Other figures from sworn sta... to the National Automobile Chamber of Commerce.

Automobiles, including parts, except tires—Imports by countries (fiscal yea...

Imported from—	1910	1911	1912	1913	...
United Kingdom	$286,324	$354,400	$537,125	$317,605	
Canada	71,376	106,868	178,999	33,939	
France	2,055,162	953,499	1,072,193	950,703	
Italy	683,543	256,118	209,902	224,902	
Germany	625,336	389,259	278,086	283,435	
All other	135,343	190,615	162,040	213,630	
Total	3,837,084	2,250,759	2,438,325	2,023,207	1

Imported from—	1915	1916	1917
United Kingdom	$558,028	$219,726	$210,771
Canada	50,335	585,487	28,565
France	319,956	170,929	32,472
Italy	354,596	172,482	154,209
Germany	20,649	21	.....
All other	68,848	24,908	2,232
Total	1,372,412	1,173,553	428,249

Automobiles, including parts, except tires—Imports by countries (calendar yea...

Imported from—	1918
United Kingdom	$12,350
Canada	41,509
France	140
Italy	3,673
All other	440
Total	58,112

Automobiles, exclusive of parts—Imports by countries (fiscal years)

Imported from—	1910		1911		1912	
	Number.	Value.	Number.	Value.	Number.	V...
United Kingdom	101	$236,015	128	$297,382	188	
Canada	36	69,737	38	98,019	75	
France	782	1,467,646	377	797,931	401	
Italy	352	587,052	130	239,079	131	
Germany	150	368,219	137	297,153	116	
All other	52	122,777	78	169,279	52	
Total	1,473	2,851,446	888	1,898,843	963	

Automobiles, exclusive of parts—Imports by countries (fiscal years)—Continued.

Imported from—	1913		1914		1915	
	Number.	Value.	Number.	Value.	Number.	Value.
United Kingdom	78	$218,932	40	$115,042	74	$179,765
Canada	19	32,815	25	29,940	42	35,143
France	357	844,392	134	304,716	62	131,936
Italy	116	205,931	55	79,464	111	122,446
Germany	99	261,168	21	45,680	6	13,606
All other	79	196,142	25	45,651	27	42,407
Total	748	1,759,380	300	620,493	322	525,303

Imported from—	1916		1917		1918	
	Number.	Value.	Number.	Value.	Number.	Value.
United Kingdom	37	$81,418	58	$137,469	13	$29,658
Canada	1,350	579,168	31	18,114	35	21,240
France	49	115,643	11	29,497	.....	.....
Italy	1	1,023	1	1,100	1	1,280
All other	37	24,659	4	2,100	1	400
Total	1,474	801,911	105	188,280	50	52,578

Automobiles, exclusive of parts—Imports by countries (calendar years)

Imported from—	1918		1919	
	Number.	Value.	Number.	Value.
France	.....	.....	13	$58,499
Italy	.....	.....	5	14,160
United Kingdom	4	$9,925	3	16,483
Canada	68	29,548	94	33,483
Mexico	1	260	1	200
Australia	.....	.....	1	200
Total	73	39,733	117	123,025

Automobiles, including chassis, bodies, engines, and all other finished parts, except tires—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Number. (complete cars).	Value (including parts).	Duty collected.	Value per unit of quantity. (complete cars only).	Actual and computed ad valorem rate.
						Per cent.
1907	45 per cent ad valorem.	1,100	$4,668,227.00	$2,100,701.15	$3,566.94	45
1908	....do	999	2,873,467.00	1,293,060.15	2,377.57	45
1909	....do	1,467	3,375,570.00	1,518 340.50	1,772.80	45
1910	....do	1,305	3,758,412.75	1,690,322.73	2,152.84	45
1911	....do	792	2,026,888.00	910,345.04	2,104.79	45
1912	....do	872	2,199,567.00	989,805.15	2,178.51	45
1913	....do	708	1,934,728.00	870,625.35	2,344.58	45
1914	45 and 30 per cent ad valorem.[1]	281	1,354,955.00	482,786.55	2,102.74	45-30
1915	....do	258	1,188,024.00	381.449.10	1,460.36	45-30
1916	....do	185	670,721.00	227,184.75	1,445.12	45-30
1917	....do	115	436,540.00	159,321.60	1,873.12	45-30
1918	....do	62	163,894.00	54,155.10	1,145.98	45-30
1918[2]	....do	75	80,695.00	25,788.00	392.00	45-30
1919[2]	....do	115	394,093.00	138,023.85	974.00	45-30
1920[2]	....do	904	2,132,737.00	696,617.85	1,059.00	45-30

[1] 45 per cent ad valorem under law of 1909; 45 per cent ad valorem under law of 1913 for cars $2,000 or over in value, and for bodies; 30 per cent ad valorem under law of 1913 for cars under $2,000 in value, and for parts and chassis.
[2] Calendar year.

Automobiles valued under $2,000 each—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Number.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1915	30 per cent ad valorem.	210	$217,196	$64,579.80	$1,029.98	30
1916	do	140	119,562	35,868.60	854.01	30
1917	do	67	65,331	19,599.30	975.09	30
1918	do	53	43,675	13,078.50	824.05	30
1919	do	86	26,037	7,811.10	302.75	30
1918 [1]	do	72	21,134	6,340.20	293.53	30
1919 [1]	do	97	32,130	9,639.00	331.24	30
1920 [1]	do	811	659,975	197,992.50	813.78	30

[1] Calendar year.

Imports not classified as to value prior to 1915.

Automobiles valued at $2,000 or over—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Number.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1915	45 per cent ad valorem.	48	$160,587	$71,364.15	$3,374.20	45
1916	do	45	147,786	66,503.70	3,061.91	45
1917	do	48	150,078	67,535.10	3,126.62	45
1918	do	9	27,376	12,319.20	3,041.67	45
1919	do	3	10,900	4,905.00	3,633.33	45
1918 [1]	do	3	8,175	3,678.75	2,725.00	45
1919 [1]	do	18	79,907	35,958.15	4,439.28	45
1920 [1]	do	93	297,428	133,842.60	3,198.15	45

[1] Calendar year.

Imports not classified as to value prior to 1915.

Chassis, bodies, engines, and other finished parts of automobiles, not including tires—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Number.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1907	45 per cent ad valorem.		$744,593.00	$335,066.85		45
1908	do		498,270.00	224,221.50		45
1909	do		771,014.00	346,956.30		45
1910	do		948,976.75	427,039.53		45
1911	do		360,204.00	162,091.80		45
1912	do		299,902.00	134,955.90		45
1913	do		274,768.00	123,643.35		45
1914	45 and 30 per cent ad valorem.		[1] 764,781.00	[2] 241,928.25		45-30
1915	do		810,241.00	245,505.15		45-30
1916	do		403,373.00	124,812.45		45-30
1917	do		221,131.00	72,187.20		45-30
1918	do		92,843.00	28,757.40		45-30
1919	do		46,787.00	14,094.60		45-30
1918 [3]	do		51,386.00	15,769.05		45-30
1919 [3]	do		282,056.00	92,426.70		45-30
1920 [3]	do		1,175,334.00	364,782.75		45-30

[1] $51,860 under law of 1909. [2] $23,337 under law of 1909. [3] Calendar year.

Automobile bodies—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
.....	45 per cent ad valorem.	23	$20,387	$9,174.15	$886.35	45
.....	....do.....	34	25,345	11,405.25	745.44	45
.....	....do.....	27	39,028	17,562.60	1,445.48	45
.....	....do.....	16	6,036	2,716.20	377.25	45
.....	....do.....	3	390	175.50	130.00	45
.....	....do.....	11	2,355	1,059.75	214.09	45
.....	....do.....	1,004	52,066	23,429.70	51.86	45
.....	....do.....	380	81,397	36,628.65	214.20	45

· year.

les, parts, and engines, excluding separate tires—Domestic exports (fiscal years).

ported to—	1910		1911		1912	
	Number.[1]	Value.[2]	Number.[1]	Value.[2]	Number.[1]	Value.[2]
.....	3,102	$4,363,694	4,687	$6,774,769	6,288	$10,722,442
gdom.....	1,271	2,656,214	2,249	2,595,679	5,716	5,389,682
.....	246	825,904	310	532,121	574	556,064
d New Zealand...	268	196,827	343	442,715	727	930,796
.....	514	350,193	1,459	1,327,807	3,550	3,336,025
.....	120	236,480	157	240,283	202	266,695
.....	3	2,487	16	15,715	30	42,950
.....	12	30,134	61	63,930	118	183,300
h Africa.....	75	75,840	135	142,220	331	335,729
.....	245	540,325	350	649,666	273	468,407
.....	20	25,056	96	155,779	177	247,816
.....	64	75,489	181	240,852	554	698,563
.....	986	1,811,577	1,759	2,327,693	3,217	3,256,923
.....	6,926	11,190,220	11,803	15,509,229	21,757	26,435,392

orted to—	1913		1914		1915	
	Number.[1]	Value.[2]	Number.[1]	Value.[2]	Number.[1]	Value.[2]
.....	7,212	$13,091,360	4,624	$9,654,725	4,433	$7,240,113
gdom.....	3,979	4,911,516	7,222	8,455,402	13,934	25,775,712
.....	824	791,745	1,429	1,106,860	5,441	14,265,204
.....	1,097	1,333,873	988	1,121,444	629	347,737
d New Zealand...	3,059	3,116,425	4,235	3,949,446	3,184	2,919,622
.....	237	302,971	316	336,410	1,380	882,436
.....	78	114,693	197	194,312	120	79,048
.....	333	448,896	97	137,532	29	58,965
h Africa.....	1,290	1,229,675	1,530	1,606,969	710	872,263
.....	270	553,489	167	298,483	78	112,290
.....	216	325,511	184	189,535	45	40,065
.....	1,023	1,219,179	312	370,043	84	84,673
.....	5,668	5,542,796	7,689	7,169,538	7,809	16,832,024
.....	25,286	32,982,129	29,090	34,590,699	37,876	69,510,152

orted to—	1916		1917		1918	
	Number.[1]	Value.[2]	Number.[1]	Value.[2]	Number.[1]	Value.[2]
.....	10,404	$15,867,144	15,057	$23,042,595	14,093	$26,368,158
dom.....	18,528	34,693,986	7,797	25,161,237	6,144	23,313,720
.....	7,768	21,446,896	5,631	18,792,680	3,923	15,731,456
.....	4,444	2,321,139	4,065	3,940,520	3,576	6,520,413
l New Zealand...	8,301	7,218,375	8,878	7,752,081	6,308	6,542,979
.....	3,815	2,684,720	3,926	4,174,739	3,529	5,192,797
.....	843	649,716	2,656	2,230,906	3,619	4,667,572
.....	168	165,035	722	657,566	2,418	2,678,935
a Africa.....	2,895	2,382,447	3,457	2,888,263	2,212	2,626,252
.....	434	453,436	3,025	1,968,183	2,943	2,613,556
.....	287	183,444	1,169	749,188	2,248	1,376,277
.....	282	237,931	887	666,009	1,599	1,254,558
.....	19,330	34,329,441	23,515	29,171,001	11,900	15,379,415
.....	77,499	122,633,710	80,785	121,194,968	64,512	114,266,088

[1] Complete cars. [2] Including parts and engines.

Automobiles, parts, and engines, excluding separate tires—Domestic exports (
years).

Exported to—	1918		1919		1920	
	Number.[1]	Value.[2]	Number.[1]	Value.[2]	Number.	
Canada	10,138	$24,181,362	10,684	$33,673,041	10,196	$4
United Kingdom	2,687	14,900,285	6,996	14,355,264	25,376	5
France	4,359	19,559,035	4,387	19,152,415	717	
Argentina	1,673	4,098,478	2,347	6,761,087	4,949	1
Australia and New Zealand	5,366	6,690,790	7,507	10,407,972	17,061	2
Cuba	2,466	4,818,286	3,802	6,682,738	8,246	1
Chile	1,888	3,217,970	542	1,418,083	1,096	
Japan	3,304	4,205,589	3,948	5,383,127	4,029	
British South Africa	1,241	1,587,650	3,076	4,445,874	6,932	
Mexico	2,313	2,674,384	3,788	4,282,403	5,370	
Uruguay	1,366	951,290	1,912	2,209,392	4,203	
Brazil	1,145	1,120,690	3,473	3,587,630	7,791	1
All other	9,298	12,983,160	30,268	44,067,465	75,678	11
Total	47,244	100,888,969	82,730	156,426,491	171,644	30

[1] Complete cars. [2] Including parts and engines.

Automobiles, passenger and commercial, excluding all parts[1]—Domestic exports
years).

Exported to—	1910		1911		1912	
	Number.	Value.	Number.	Value.	Number.	V
Canada	3,102	$3,340,326	4,687	$5,047,927	6,288	$7,
United Kingdom	1,271	2,415,593	2,249	2,278,222	5,716	4,
France	246	771,869	310	473,122	574	
Argentina	268	174,677	343	423,193	727	
Australia and New Zealand	514	323,510	1,459	1,257,561	3,550	3,
Cuba	120	187,392	157	206,960	202	
Chile	3	1,824	16	15,231	30	
Japan	12	26,759	61	58,933	118	
British South Africa	75	61,185	135	126,734	331	
Mexico	245	459,077	350	614,160	273	
Uruguay	20	23,666	96	147,142	177	
Brazil	64	67,687	181	225,083	554	
All other	986	1,695,135	1,759	2,093,781	3,217	2,
Total	6,926	9,548,700	11,803	12,965,049	21,757	21,

[1] Stated separately as "Commercial" and "Passenger" after 1912.

Automobiles, commercial, excluding all parts[1]—Domestic exports (fiscal year

Exported to—	1913		1914		1915	
	Number.	Value.	Number.	Value.	Number.	V
Canada	489	$1,004,237	247	$474,724	306	$
United Kingdom	184	119,468	203	189,099	5,311	14,
France	6	10,709	2	5,070	4,990	13,
Argentina	35	78,000	48	65,225	3	
Australia and New Zealand	18	24,228	71	98,977	77	
Cuba	14	23,639	19	33,500	21	
Chile			2	10,743		
Japan	21	32,770	1	900	1	
British South Africa	11	9,476	12	11,539	15	
Mexico	35	83,363	12	17,509	8	
Uruguay	7	19,280	1	865		
Brazil	36	75,073	13	20,449	3	
All other	137	256,898	153	253,011	3,261	10,
Total	993	1,737,141	784	1,181,611	13,996	39,

[1] Included in "Automobiles" prior to 1913.

mobiles, commercial, excluding all parts—Domestic exports (fiscal years)—Contd.

Exported to—	1916		1917		1918	
	Number.	Value.	Number.	Value.	Number.	Value.
a	387	$724,817	636	$945,047	1,108	$1,381,542
l Kingdom	8,500	19,034,924	6,525	17,061,105	5,257	14,642,309
e	5,681	17,709,579	4,264	13,854,903	2,754	10,001,626
tina	45	33,063	141	146,255	51	50,124
lia and New Zealand	294	445,386	269	356,992	183	309,169
	117	176,647	397	722,519	554	1,130,982
	17	46,566	69	160,696	220	282,638
	15	14,528	70	59,198	279	317,787
n South Africa	36	54,519	34	82,957	70	107,085
o	51	100,500	218	198,151	365	525,664
ay	2	5,818	4	10,437	16	15,809
	11	19,635	14	8,300	24	31,133
ner	6,109	18,439,566	3,336	8,736,942	1,319	3,078,591
Total	21,265	56,805,548	15,977	42,343,502	12,200	31,874,459

utomobiles, commercial, excluding all parts—Domestic exports (calendar years).

Exported to—	1918		1919		1920	
	Number.	Value.	Number.	Value.	Number.	Value.
a	1,596	$2,035,464	1,858	$2,896,325	2,149	$4,187,597
l Kingdom	2,264	6,671,230	907	1,364,302	5,202	7,373,380
e	3,356	12,920,029	3,521	15,143,226	135	424,943
tina	45	40,707	145	291,430	352	825,333
lia and New Zealand	122	194,469	643	1,066,894	1,508	2,596,084
	557	1,109,368	915	1,955,509	1,953	4,937,281
	154	239,621	88	131,055	299	326,216
n South Africa	605	895,125	1,143	1,736,439	1,233	1,590,760
o	397	524,035	938	1,205,664	1,281	1,973,994
ay	15	13,512	68	79,196	113	113,679
	37	42,481	200	199,738	1,540	1,191,577
ner	1,124	2,084,657	5,102	9,252,667	13,127	20,799,998
Total	10,308	26,814,952	15,585	35,425,437	29,136	46,775,781

Automobiles, passenger, excluding all parts [1]*—Domestic exports (fiscal years).*

Exported to—	1913		1914		1915	
	Number.	Value.	Number.	Value.	Number.	Value.
a	6,723	$8,229,324	4,377	$5,445,052	4,127	$3,723,125
l Kingdom	3,795	2,907,427	7,019	5,664,028	8,623	7,068,944
e	818	615,086	1,427	919,060	451	252,909
tina	1,062	1,181,735	940	963,586	626	294,129
lia and New Zealand	3,041	2,887,827	4,164	3,590,604	3,107	2,552,685
	223	242,686	297	254,428	1,359	745,695
	78	109,982	195	160,194	120	64,327
South Africa	312	364,507	96	100,995	28	29,210
	1,279	1,187,895	1,618	1,437,883	695	731,278
ay	235	423,123	155	239,166	70	66,830
	209	273,253	183	167,269	45	25,706
er	987	1,035,247	299	264,992	81	52,939
otal	5,531	4,847,701	7,536	6,185,706	4,548	5,486,176
	24,293	24,275,793	28,306	25,392,963	23,880	21,113,953

[1] ...nded in "Automobiles" prior to 1913.

Automobiles, passenger, excluding all parts—Domestic exports (fiscal years)—Contd.

Exported to—	1916		1917		1918	
	Number.	Value.	Number.	Value.	Number.	Value.
Canada	10,017	$6,555,334	14,421	$11,143,740	12,985	$10,189,[illegible]
United Kingdom	10,028	7,112,958	1,272	1,447,337	892	1,929,[illegible]
France	2,087	1,428,325	1,367	836,557	1,109	1,[illegible]
Argentina	4,399	2,065,439	3,924	2,336,001	3,525	2,666,[illegible]
Australia and New Zealand	8,007	6,203,145	8,609	6,350,689	6,125	4,953,[illegible]
Cuba	3,698	2,091,295	3,529	2,545,071	2,975	3,028,[illegible]
Chile	826	530,211	2,587	1,821,842	3,399	3,578,[illegible]
Japan	153	120,061	652	481,748	2,139	2,042,[illegible]
British South Africa	2,859	2,040,977	3,423	2,378,380	2,142	1,708,[illegible]
Mexico	383	309,200	2,807	1,642,011	2,578	1,653,[illegible]
Uruguay	285	150,510	1,165	612,838	2,232	1,177,[illegible]
Brazil	272	157,968	873	523,383	1,575	1,000,[illegible]
All other	13,220	11,894,810	20,179	16,493,035	10,576	9,977,[illegible]
Total	56,234	40,660,263	64,808	48,612,632	52,312	45,331,[illegible]

Automobiles, passenger, excluding all parts—Domestic exports (calendar years).

Exported to—	1918		1919		1920	
	Number.	Value.	Number.	Value.	Number.	Value
Canada	8,542	$7,140,776	8,826	$9,393,009	8,017	$10,872,[illegible]
United Kingdom	423	1,082,342	6,089	6,505,541	20,174	22,[illegible]
France	1,003	1,134,[illegible]18	886	1,999,773	562	935,[illegible]
Argentina	1,628	1,673,137	2,202	2,711,232	4,597	5,[illegible]
Australia and New Zealand	5,244	4,500,181	6,804	7,331,642	15,553	18,127,[illegible]
Cuba	1,909	2,638,001	2,887	3,121,228	6,293	7,096,[illegible]
Chile	1,734	2,315,896	454	700,997	797	[illegible],[illegible]
Japan	2,699	2,877,692	2,805	2,890,034	2,796	2,963,[illegible]
British South Africa	1,205	1,070,570	3,019	3,462,330	6,688	7,785,[illegible]
Mexico	1,916	1,539,893	2,850	2,360,346	4,089	3,325,[illegible]
Uruguay	1,351	799,787	1,844	1,757,623	4,090	4,055,[illegible]
Brazil	1,108	856,374	3,273	2,590,304	6,251	6,761,[illegible]
All other	8,174	8,649,335	25,166	28,896,468	62,351	73,679,[illegible]
Total	39,936	36,278,292	67,145	73,700,527	142,508	165,253,[illegible]

Automobiles, parts of (not including engines and tires)—Domestic exports (fiscal years)

Exported to—	1910	1911	1912	1913	1914	1915
Canada	$1,023,368	$1,726,842	$2,392,592	$3,104,087	$3,663,879	$2,741,[illegible]
United Kingdom	240,621	322,457	933,306	924,802	1,305,907	3,312,[illegible]
France	51,035	58,909	85,537	165,950	179,351	480,[illegible]
Argentina	22,151	19,522	70,446	74,138	92,633	44,[illegible]
Australia and New Zealand	26,683	70,246	128,522	203,614	256,007	247,[illegible]
Cuba	49,088	31,523	31,594	35,928	48,217	101,[illegible]
Chile	663	484	2,456	4,711	22,405	14,[illegible]
Japan	3,375	4,947	39,681	51,619	35,647	28,[illegible]
British South Africa	14,655	15,186	29,124	62,304	157,246	140,[illegible]
Mexico	81,248	35,509	47,479	46,713	41,509	30,[illegible]
Uruguay	1,390	8,637	12,599	32,978	21,401	14,[illegible]
Brazil	7,802	15,769	35,680	108,859	84,602	28,[illegible]
All other	116,142	245,912	297,940	424,856	715,439	705,[illegible]
Total	1,641,520	2,544,180	4,107,155	5,240,599	6,624,232	7,853,[illegible]

Exported to—	1916	1917	1918	1918[1]	1919[1]	1920[1]
Canada	$7,492,639	$9,148,110	$12,054,824	$11,617,494	$16,985,619	$22,814,[illegible]
United Kingdom	7,252,070	6,141,621	6,330,069	7,106,385	6,439,379	22,662,[illegible]
France	2,216,823	3,700,812	3,979,904	5,060,426	1,995,719	3,980,[illegible]
Argentina	222,037	1,458,111	3,088,534	2,100,114	3,753,370	7,265,[illegible]
Australia and New Zealand	566,708	1,038,985	1,362,644	1,989,048	1,991,340	2,904,[illegible]
Cuba	411,751	999,719	1,028,279	1,065,816	1,582,241	2,288,[illegible]
Chile	72,939	248,045	806,015	659,544	586,051	436,[illegible]
Japan	30,446	116,130	319,038	429,543	719,401	624,[illegible]
British South Africa	286,401	422,209	811,323	472,456	878,723	1,[illegible]
Mexico	42,258	125,823	431,440	506,747	704,875	1,[illegible]
Uruguay	27,089	125,913	183,665	137,991	372,223	[illegible]
Brazil	70,935	134,726	223,114	221,845	806,556	1,[illegible]
All other	3,845,212	3,851,151	2,204,520	2,230,751	5,985,602	16,807,[illegible]
Total	22,536,185	27,420,913	32,933,069	33,607,050	42,562,186	86,[illegible]

[1] Calendar year.

Automobile engines[1]*—Domestic exports (fiscal years).*

rted to—	1912		1913		1914		1915	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
.....	6,844	$769,195	8,906	$753,702	353	$71,070	465	$70,597
Kingdom...	15	1,928	2,425	959,819	3,345	1,296,368	8,813	1,313,576
.....	1	806	.....	.....	25	3,379	27	7,688
ia.....	.....	.....	.....	.....	.....	.....	2	708
a and New								
id.....	2	447	2	756	27	3,858	39	3,955
.....	3	532	5	718	2	265	3	705
.....	2	421	.....	.....	2	970	.....	.....
.....	.....	.....	.....	.....	.....	.....	6	345
outh Africa	.....	.....	.....	.....	2	301	3	465
.....	10	2,329	1	260	3	300	1	149
.....	1	120	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	2	240
.....	13	2,320	63	13,341	84	15,382	20	3,906
tal.....	6,891	778,098	11,402	1,728,596	3,843	1,391,893	9,381	1,402,334

Exported to—	1916		1917		1918	
	Number.	Value.	Number.	Value.	Number.	Value.
.....	8,426	$1,094,354	16,668	$1,805,698	24,175	$2,741,927
Kingdom.....	11,020	1,284,034	4,858	508,174	3,715	411,670
.....	485	92,169	1,395	400,408	1,479	211,068
ia.....	.....	.....	2	153	6,075	714,857
a and New Zealand...	20	3,536	41	5,437	53	7,298
.....	24	5,047	2	439	13	3,726
.....	.....	.....	1	325	19	2,408
.....	.....	.....	1	490	7	1,213
South Africa.....	3	550	21	4,726	20	1,708
.....	4	1,478	8	2,198	19	2,907
.....	.....	.....	.....	.....	.....	.....
.....	1	393	.....	.....	.....	.....
.....	689	149,853	378	89,873	262	28,475
tal.....	20,672	2,631,414	23,375	2,817,921	35,837	4,127,257

ded in "All other engines and parts of" prior to 1912.

Automobile engines—Domestic exports (calendar years).

Exported to—	1918		1919		1920	
	Number.	Value.	Number.	Value.	Number.	Value.
.....	26,661	$3,387,628	30,387	$4,518,088	28,732	$4,531,489
Kingdom.....	302	40,328	227	46,042	543	116,420
.....	1,142	434,762	402	42,697	677	187,358
a.....	2,497	284,520	7	5,055	16	4,511
a and New Zealand...	46	7,092	86	18,106	62	18,371
.....	13	5,101	46	23,760	14	5,569
.....	18	3,419	.....	.....	11	5,594
.....	14	3,229	79	37,194	152	58,815
South Africa.....	2	470	5	1,829	13	2,928
.....	21	3,709	27	11,520	29	8,798
.....	.....	.....	1	350	.....	.....
.....	.....	.....	3	1,032	.....	.....
.....	97	18,417	88	32,668	332	92,013
tal.....	30,813	4,188,675	31,358	4,738,341	30,581	5,031,856

Automobiles, prices retail, f. o. b. factories.

Kind or grade.	1910	1911	1912	1913	1914	1915
Pierce Arrow, 6 cylinder, 38 horsepower	$4,000	$4,000	$4,000	$4,300	$4,300	[illegible]
Packard, 12 cylinder, 43 horsepower	4,200	4,200	5,000	4,750	3,500	4,[illegible]
Winton, 6 cylinder, 33 horsepower	3,000	3,000	3,000	3,000	3,250	3,[illegible]
Hudson, 6 cylinder, 30 horsepower					2,250	2,[illegible]
Buick, 6 cylinder, 7 passenger	1,750	1,500	1,250	1,285	1,325	1,[illegible]
Buick, 6 cylinder, 5 passenger	1,400	1,150	1,060	1,050	1,020	[illegible]
Overland, 4 cylinder, 32 horsepower	1,400	1,095	900	985	950	[illegible]
Ford, 4 cylinder, 20 horsepower	950	780	690	600	550	[illegible]

Kinds or grades.	1916	1917	1918	1919	1920
Pierce Arrow, 6-cylinder, 38-horsepower	$4,300	$4,800	$4,800	$6,500	$7,[illegible]
Packard, 12-cylinder, 43-horsepower	3,150	3,500	4,100	4,800	5,[illegible]
Winton, 6-cylinder, 48 horsepower	2,285	2,685	2,950	3,150	4,[illegible]
Hudson, 6-cylinder, 30-horsepower	1,375	1,650	1,950	2,200	[illegible]
Buick, 27-horsepower, 6-cylinder, 7-passenger	1,485	1,070	1,495	1,785	1,[illegible]
Buick, 27-horsepower, 6-cylinder, 5-passenger	985	675	795	1,495	1,[illegible]
Overland, 4-cylinder, 18-horsepower	615	665	795	985	[illegible]
Ford, 4-cylinder, 22-horsepower	440	360	360	525	[illegible]

The above prices are all for touring models, and while they afford an indication of the general trend of prices it should be noted that changes in design from year to year in some cases have affected the price considerably. The Ford car has remained the most nearly uniform in design during the period considered.

Automobiles—Rates of duty

Prior to the act of 1909 automobiles were dutiable according to component material of chief value.

Act of—	Par.	Tariff classification or description.	Rates of duty specific and ad valorem.
1909	141	Automobiles * * * and finished parts of any of the foregoing, not including tires.	45 per cent ad valorem.
1913	119	Automobiles valued at $2,000 or more, and automobile bodies	Do.
		Automobiles valued at less than $2,000	30 per cent ad valorem.
		Automobile chassis, and finished parts of automobiles, not including tires.	Do.

Court and Treasury Decisions.

Some parts of automobiles are specifically provided for elsewhere than in paragraph 119 of the act of 1913. Sprocket chains, for example, have been held dutiable at 25 per cent under paragraph 126 (Abstract 36332, T. D. 34742, and Abstract 36781, T. D. 34871 of 1914), whether assembled or unassembled, but repair or extra parts are dutiable under paragraph 167. (Abstracts 39315 and 39447 of 1916.)

Horns and magneto windings and condensers, not being limited in their use to automobiles, also do not come within paragraph 119. (Abstract 24259, T. D. 31070 of 1910, and Abstract 37984 of 1915.) But oilers used on automobiles to cover the oil holes leading to the bearings and intended to keep the holes free from dirt, dust, etc., are dutiable as parts of automobiles under this paragraph. (Abstract 40076 of 1916.)

The tires contemplated in this paragraph are those which are imported as separate entities and not those which accompany automobiles as essential and integral parts. (G. A. 8123, T. D. 37491 of 1918.)

Repairs abroad to an automobile of foreign make are dutiable at the same rate as would be levied upon the automobile if the auto-

obile itself were dutiable upon the return of the automobile to the nited States. (G. A. 7789, T. D. 35795 of 1915.)

MISCELLANEOUS.

The successful manufacture of automobiles requires an abundant pply of steel and skilled labor, engineering, and inventive ability, d for successful competition the ability to organize and execute a large scale.

The demand will depend upon the prosperity of the population and e extent to which there exists a class capable of demanding conniences and luxuries as well as necessities, and in the case of comercial vehicles by the progressiveness of business men and to some tent by lack of railroad facilities, as in some mountainous regions. rom prosperous agricultural countries, such as South America, Aus-alia, South Africa, and some of the West Indies, we should expect large demand, while countries in which manufacturing is highly eveloped, as the United States, England, France, and Germany, will pply their own requirements and be in a position to export.

DISTRIBUTION OF AUTOMOBILES IN THE WORLD.

During 1918 there were 6,146,617 motor cars registered in the nited States, and in 1920 registration had increased to 9,211,295, which 11 per cent were commercial vehicles. The Department of griculture estimates that there were in 1918 about 7,000,000 motor hicles in the world, of which the United States had over 87 per nt, Europe 7 per cent, Canada about 4 per cent, and the remainder North and South America 1 per cent. The number in Europe was out equal to the number in New York State.[1] The normal replacent of motor cars is estimated at about 16 per cent per year.

Exports of principal producing countries.

Year.	United States.[a]	France.[b]	United Kingdom.[c]	Italy.[d]	Germany.[e]	Canada.[f]
		$29,322,800	$7,583,485		$4,066,000	
	$11,190,220	32,375,120	12,636,807		6,931,000	
	15,500,229	32,477,820	15,356,254	$6,222,792	10,099,000	
	26,435,392	42,399,480	17,859,970	7,743,152	15,483,000	
	32,982,129	45,489,400	17,701,972	6,836,178	16,897,000	
	34,590,609		16,705,711	8,134,399		
	69,510,152		9,136,931	12,676,195		
	122,633,710		10,810,730	16,806,450		
	121,194,968		8,788,334	22,995,761		$4,604,899
	114,266,088		12,138,121	9,068,500		3,807,278
	156,428,491[h]			12,096,967		[g] 5,989,909
	393,261,571[h]					

Reports in Commerce and Navigation, Department of Commerce, fiscal year.
Automotive Industries, Jan. 15, 1920, p. 117.
Annual Statement, Trade of the United Kingdom, 1913 and 1918.
Automotive Industries, Jan. 12, 1919, and June 6, 1918, said to have been compiled by Italian minister nance.
Automotive Industries, Feb. 13, 1919 (passenger cars only).
Commerce Report, Jan. 6, 1920.
Standard Daily Trade Service, Oct. 28, 1919, fiscal year ending Mar. 31.
Calendar year.
A. P. Anderson, highway engineer, "Public Roads," Department of Agriculture.

Comparison of exports by United States and Germany [1] *(passenger cars only).*

Country.	1911		1912		1913	
	United States.	Germany.	United States.	Germany.	United States.	Germany.
Austra'ia	8867,000	$117,000	$2,260,000	$177,000	$1,897,000	[illegible]
United Kingdom	2,273,000	1,316,000	4,454,000	1,737,000	2,907,000	1,211,[illegible]
South Africa	126,000	63,000	306,000	45,000	1,157,000	136,[illegible]
Brazil	225,000	640,000	622,000	1,586,000	1,035,000	857,[illegible]
Argentina	423,000	589,000	860,000	1,480,000	1,181,000	1,228,[illegible]
France	473,000	672,000	469,000	836,000	615,000	803,[illegible]
Austria	28,000	1,211,000	79,000	1,699,000	92,000	1,726,[illegible]
Russia	139,000	1,823,000	254,000	2,540,000	484,000	4,222,[illegible]
Total	12,965,000	10,099,000	21,550,000	15,483,000	24,275,000	16,573,[illegible]

Automotive Industries, Feb. 13, 1919.

Specifications of current motor truck models. [1]

Name and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
A. & B, 3T	3	.....	5¼ by 4½	48 by 3½d	48 by 3½d	I.
A. & B, 5T	5	.....	5¼ by 3½	48 by 3½d	48 by 5d	I.
Acason, R	1	.....	3½ by 5½	36 by 3½	36 by 5	W.
Acason, RB	1½	.....	3½ by 5½	36 by 3½	36 by 6	W.
Acason, H	2½	.....	4½ by 5½	36 by 4	36 by 8	W.
Acason, L	3½	.....	4½ by 5½	36 by 5	36 by 5d	W.
Acason, M	5	.....	5 by 6½	36 by 6	40 by 6d	W.
Ace, C	1½	$2,750	3½ by 5½	*34 by 3½	*34 by	W.
Ace, A	2½	3,450	4½ by 5½	*36 by 4	36 by	W.
Ace	3	3,650	4½ by 5½	36 by 6	36 by	W.
Acme, B	1	2,175	3½ by 5	34 by 3½	34 by	W.
Acme, F	1½	2,475	3½ by 5	34 by 3½	34 by	W.
Acme, A	2	3,050	4½ by 5½	36 by	*36 by	W.
Acme, C	3½	4,050	4½ by 5½	36 by	*40 by 10	W.
Acme, E	5	5,150	4½ by 6	36 by 6	*40 by 12	W.
Air-O-Flex, C	1½	.....	3½ by 5½	36 by 3½	36 by 5	I.
All-Power, C	3½	5,800	4½ by 6	36 by 7	36 by 10	W.
All-American, B-1	1	1,795	3½ by 5	32 by 4	32 by 4	I.
All-American, C-1½	1½	2,195	3½ by 5	34 by 4	34 by 5	I.
American, 40	4	4,575	4½ by 6	36 by 5	36 by 10	W.
Apex, C	1	1,745	3½ by 5½	†33 by 4	32 by 3½	I.
Apex, D	1½	1,915	3½ by 5½	32 by 3½	32 by 4	I.
Apex, E	2½	2,695	4½ by 5½	36 by 4	36 by 6	I.
Armleder, HW	2½	.....	4½ by 5½	36 by 4	36 by 4d	W.
Armleder, KW	3½	.....	4½ by 6	36 by 5	36 by 5d	W.
Armleder, 20	1	.....	3½ by 5½	34 by 3½	34 by 5	W.
Atco	1½	2,450	3½ by 5½	*34 by 5	*36 by 6	I.
Atco	2½	3,150	4½ by 5½	36 by 4	*36 by 7	W.
Atlas, 1	1	.....	3½ by 5	32 by 4½	.....	W.
Atterbury, 20R	1½	2,775	3½ by 5	34 by 3½	34 by 5	W.
Atterbury, 7CX	2½	3,575	4½ by 5½	36 by 4	36 by 4d	W.
Atterbury, 7D	3½	4,375	4½ by 5½	36 by 5	40 by 5d	W.
Atterbury, 8E	5	5,975	4½ by 6	36 by 5	40 by 6d	W.
Autocar, 21UF	2	2,300	*4½ by 4½	34 by 4	34 by 5	D.
Autocar, 21UG	2	2,400	*4½ by 4½	31 by 4	34 by 5	D.
Autohorse, 10	5	2,100	3½ by 5	34 by 10	.....	I.
Available, H1½	1½	2,750	4 by 5½	†35 by 5	†38 by 7	W.
Available, H2½	2½	3,475	4½ by 5½	*36 by	36 by 8	W.
Available, H3½	3½	4,475	4½ by 5½	36 by 5	40 by 10	W.
Available, H5	5	5,575	4½ by 6	36 by 6	40 by 12	W.
Available, H7	7	6,875	5 by 6½	36 by 6	40 by 14	D.
Avery	1	.....	3 by 4	†34 by 5	†34 by 5	
Beck, AJr	1	1,800	3½ by 5	34 by 3½	34 by 4	I.
Beck, C	2	2,550	4½ by 5½	36 by 4	36 by 6	I.
Bell, O	2½	.....	4½ by 5½	34 by 4	*34 by	I.
Bell, E	1½	.....	3½ by 5½	35 by 5	36 by 6	I.
Belmont, A	.....	.....	3½ by 4½	31 by 4	.....	I.
Belmont, B	1½	.....	3½ by 5½	34 by 4½	34 by 5	I.
Belmont, C	2	.....	4½ by 5½	36 by 4	36 by 7	I.
Belmont, AA	½	1,150	3½ by 5	†31 by 4	†31 by 4	I.

[1] Motor World, Dec. 4, 1919.

*2-cylinder. †6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield. Trac., tractor.

Final drive: W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel; I external gear. *Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

me and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
B	1½	$1,950	3¾ by 5½	34 by 4½	36 by 5	I.
	1	.....	3¼ by 5	34 by 3	34 by 4	I.
-2	1½	.....	3¾ by 5	36 by 3½	36 by 5	I.
2	1½	.....	4½ by 5½	36 by 4	36 by 4	I.
-2	4	.....	4½ by 5½	36 by 6	36 by 10	I.
K	1	1,695	3½ by 5	†34 by 4½	35 by 5	I.
G	2	2,595	4 by 5½	34 by 3½	34 by 6	I.
H	3	3,095	4 by 5½	36 by 4	36 by 8	I.
J	4	3,995	4½ by 5½	36 by 5	36 by 5d	I.
	2½	2,700	4½ by 5½	36 by 4	36 by 7	W.
	1	1,595	3¼ by 5	32 by 3½	32 by 4	I.
21	4	5,050	4½ by 5½	36 by 8	36 by 8	4.
	1½	2,350	3½ by 5½	34 by 3½	34 by 5	W.
	2½	2,850	4½ by 5½	36 by 4	36 by 7	W.
C	4	3,850	4½ by 6	36 by 5	36 by 10	W.
	6	4,500	4½ by 6	36 by 5	36 by 12	W.
	2½	3,400	4½ by 5½	36 by 4	36 by 7	W.
-2	1½	2,250	3¾ by 5	36 by 3½	36 by 5	W.
-4	2½	3,200	4½ by 5½	36 by 4	36 by 7	W.
-2	3½	4,100	4½ by 5½	36 by 5	36 by 5d	W.
-5	5	5,250	4½ by 6	36 by 6	40 by 6d	W.
	1½	2,750	3¾ by 5	35 by 5	38 by 7	†W.
	2½	3,450	4½ by 6	36 by 4	36 by 8	W.
	2½	3,850	4½ by 6	36 by 6	42 by 9	†W.
	3½	4,150	4½ by 6	36 by 5	36 by 10	W.
200	¾	1,000	3½ by 5	†32 by 4	†32 by 4	B.
0	¾	820	.....	†30 by 3½	†30 by 3½	B.
	¾	920	.....	†31 by 4	†34 by 4½	B.
	1	1,325	.....	†33 by 4	†35 by 5	W.
	1½	2,750	3¾ by 5½	36 by 3½	36 by 5	W.
	2½	3,250	4 by 5½	36 by 4	36 by 7	W.
	3½	4,450	4½ by 5½	36 by 5	36 by 10	W.
	5	5,200	4½ by 5½	36 by 6	40 by 12	W.
	1½	2,450	3¾ by 5	36 by 6	38 by 7	I.
2X	1	2,375	3¾ by 5½	34 by 3½	*34 by 5	W.
2	1½	2,750	3¾ by 5½	*36 by 3½	*36 by 6	W.
5X	2½	3,540	4¼ by 5½	*36 by 4	*36 by 7	W.
0	3½	4,400	4½ by 5½	36 by 5	40 by 10	W.
20B	5	5,500	4½ by 6	36 by 6	40 by 12	W.
5EX	2½	3,775	4½ by 5½	36 by 6	36 by 7	W.
	1	.....	3¾ by 5	34 by 4	*34 by 5	W.
	1½	.....	3¾ by 5	36 by 4	*36 by 6	W.
	2	.....	4½ by 5½	36 by 4	36 by 7	W.
	1	.....	3¾ by 5	34 by 3	34 by 4	I.
	2½	.....	4 by 5	36 by 4	36 by 7	I.
	1½	.....	3¾ by 5	34 by 4	34 by 4	W.
	¾	1,350	3¾ by 5	†34 by 4½	†34 by 4½	B.
	1	1,855	3¾ by 5	*34 by 3½	*34 by 4	I.
P	1½	2,255	3¾ by 5	†36 by 6	†36 by 6	I.
	1½	2,800	3¾ by 5½	36 by 3½	36 by 5	W.
	2½	3,400	4½ by 5½	36 by 4	36 by 4d	W.
	¾	.....	3½ by 5	†32 by 4½	†32 by 4½	I.
	1	2,100	3½ by 5	*34 by 3½	*34 by 5	W.
	2	2,700	3½ by 5	36 by 4	36 by 4d	W.
	1	2,400	3½ by 5	34 by 3½	34 by 4	W.
	1½	2,800	3½ by 5	36 by 3½	36 by 5	W.
	2	3,500	4½ by 5½	36 by 3½	36 by 7	W.
	2½	3,650	4½ by 5½	36 by 4	36 by 4d	W.
	3½	4,500	4½ by 5½	36 by 5	36 by 10	W.
	5	5,500	4½ by 6	36 by 6	40 by 6d	W.
HC	3½	6,000	5½ by 5½	.. by 4	.. by 4d	
AC	5	6,700	5½ by 7	.. by 5	.. by 5d	
LD	7	7,450	5½ by 7	.. by 5	.. by 5d	
	1½	2,250	3¾ by 5½	34 by 3½	34 by 6	W.
	2½	3,000	4½ by 5½	36 by 4	36 by 7	W.
	3½	4,000	4½ by 6	36 by 5	36 by 10	W.
	1	2,100	3¾ by 5	34 by 3½	34 by 4	W.
	1½	2,300	3¾ by 5	34 by 3½	34 by 5	W.
	2	2,750	4½ by 5½	36 by 4	36 by 6	W.
	2½	2,950	4½ by 5½	36 by 4	36 by 7	W.
	3½	3,700	4½ by 5½	36 by 5	36 by 5d	W.
	5	4,600	4½ by 6	36 by 5	40 by 6d	W.
	1½	2,180	3¾ by 5	*34 by 4	*34 by 5	W.
	2	2,590	3¾ by 5½	†34 by 4½	34 by 7	W.
	1½	2,550	3¾ by 5	†35 by 5	†36 by 6	I.

†6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield tractor.

W., worm; I., internal gear; C., chains; D., double reduction; B., bevel, 4, four-wheel; ear. *Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

Name and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
Defiance, E	2	$2,750	3½ by 5	†35 by 5	†38 by 7	I.
DeKalb, E2	2	2,250	4½ by 5½	*34 by 3½	*36 by 5	W.
DeKalb, E2½	2½	2,600	4½ by 5½	*36 by 4	*36 by 6	W.
Denby, 12	1	2,400	3½ by 5	*35 by 5	*36 by 6	I.
Denby, 134	2	2,800	3½ by 5	34 by 3½	36 by 6	I.
Denby, 25	3	3,600	4½ by 5½	36 by 4	36 by 7	I.
Denby, 27	4	4,600	4½ by 5½	36 by 5	36 by 5d	I.
Denby, 210	5	5,350	4½ by 5½	36 by 6	36 by 6d	I.
Diamond-T, T	1½	2,450	3½ by 5½	36 by 3½	36 by 5	W.
Diamond-T, F	1½	2,715	3½ by 5½	36 by 3½	36 by 5	W.
Diamond-T, U	2	2,835	4 by 5½	36 by 4	36 by 7	W.
Diamond-T, K	3½	3,925	4½ by 5½	36 by 5	36 by 5d	W.
Diamond-T, FL	5	4,615	4½ by 5½	36 by 6	40 by 6d	W.
Diamond-T, S	5	4,800	4½ by 6	36 by 6	40 by 6d	W.
Diehl, A	1	.....	3½ by 5	34 by 4½	34 by 5	W.
Doane	2½	3,750	4½ by 5½	36 by 5	36 by 7	C.
Doane	3½	4,800	4½ by 5½	36 by 5	36 by 5d	C.
Doane	6	5,825	4½ by 6½	36 by 6	40 by 6d	C.
Dodge Brothers	¼	1,085	3½ by 4½	33 by 4	33 by 4	B.
Dorris, K-4	2	3,100	4½ by 5½	*36 by 4	*36 by 7	W.
Dorris, K-7	3½	4,100	4½ by 5½	*36 by 5	*36 by 10	W.
Douglas, G	1½	2,200	3½ by 5½	34 by 3½	34 by 5	I.
Douglas, H	2	2,800	4½ by 5½	34 by 4	36 by 7	I.
Douglas, I	3	3,500	4½ by 5½	36 by 5	36 by 8	W.
Duplex, Limited	1½	2,775	4 by 5½	†35 by 5	†38 by 7	L.
Duplex, E	3½	4,250	4½ by 5½	36 by 8	36 by 8	4.
Duty, 20	2	1,490	3½ by 5	34 by 3½	34 by 5	I.
Eagle, 100	2	1,995	3½ by 5½	*34 by 3½	*34 by 6	I.
Elmira, C	½	500	3½ by 4½	†28 by 3	†28 by 3	B.
Erie	1½	.....	3½ by 5	34 by 3½	36 by 5	W.
Erie	2	.....	4½ by 5½	34 by 3½	36 by 5	W.
Erie	2½	.....	4½ by 5½	34 by 4	36 by 4d	W.
Erie	3½	.....	4½ by 5½	36 by 5	40 by 5d	W.
Fageol, 1½	1½	3,000	3½ by 5½	34 by 3½	34 by 6	W.
Fageol, 2½	2½	3,000	4½ by 5½	34 by 4	36 by 7	W.
Fageol, 3½	3½	5,000	4½ by 6½	36 by 5	36 by 5d	W.
Fageol, 5	5	5,700	4½ by 6½	36 by 6	40 by 6d	W.
Famous, B10	1	1,795	3½ by 5	36 by 2½	36 by 4	I.
Famous, B12	1½	2,195	3½ by 5	36 by 3½	36 by 5	I.
Fargo, D	2	2,200	3½ by 5	36 by 4	36 by 6	I.
Federal, SD	1	2,500	3½ by 5	†35 by 5	†36 by 6	W.
Federal, TE	1½	2,725	4½ by 5½	36 by 3½	36 by 5	W.
Federal, UE	2	3,005	4½ by 5½	36 by 4	36 by 7	W.
Federal, WE	3½	3,050	4½ by 5½	36 by 5	36 by 5d	W.
Federal, XE	5	4,100	4½ by 5½	36 by 6	40 by 6d	W.
Federal, Trac	3	3,200	4½ by 5½	36 by 4	36 by 7	W.
Federal, Trac	7	4,150	4½ by 5½	36 by 5	36 by 5d	W.
Fort, TT	1	515	3½ by 4	*30 by 3½	*32 by 4½	W.
Forschler, A	1	2,100	3½ by 5	36 by 3	36 by 4	W.
Forschler, AX	1½	2,375	3½ by 5	36 by 3½	36 by 5	W.
Forschler, B	2	2,750	4½ by 5½	36 by 4	36 by 7	W.
Forschler, BX	3	3,450	4½ by 5½	36 by 4	36 by 8	W.
Frontmobile	1½	3,000	3½ by 5	36 by 6	36 by 6	W.
F. W. D., B	3	1,900	4½ by 5½	36 by 6	36 by 6	R.
Fulton, A	1	1,775	3½ by 5	†35 by 5	†35 by 5	B.
Fulton, C	2	2,350	3½ by 5	34 by 4	34 by 6	I.
Fulton, D	3	2,550	3½ by 5	36 by 4	36 by 6	I.
Garford, 25	1½	2,280	3½ by 5½	36 by 3½	36 by 4	W.
Garford, 50 H	2	3,450	4½ by 5½	36 by 4	36 by 7	W.
Garford, 60D	5	5,200	5 by 6½	36 by 6	40 by 6d	W.
Garford, 77D	3½	4,240	4½ by 6	36 by 5	36 by 5d	W.
Gary, F	1	2,100	3½ by 5	36 by 3½	36 by 4	W.
Gary, GT	1½	2,550	4 by 5½	36 by 3½	36 by 5	W.
Gary, I	2½	3,150	4½ by 5½	36 by 4	36 by 7	W.
Gary, K	3½	4,050	4½ by 6	36 by 5	40 by 5d	W.
Gary, M	5	5,150	5 by 6½	36 by 6	40 by 6d	W.
Gersix	1½	3,100	4 by 5½	36 by 3½	36 by 6	W.
Gersix	2½	3,500	4½ by 5½	36 by 4	36 by 7	W.
Gersix	3½	4,500	5 by 6½	36 by 5	40 by 10	W.
G. M. C., 16	¼	1	3½ by 5	†35 by 5	†35 by 5	B.
G. M. C., 31	1½	.....	3½ by 5	36 by 3½	36 by 5	W.
G. M. C., 41	2	.....	4½ by 5½	36 by 4	36 by 7	W.
G. M. C., 71	3½	.....	4½ by 5½	36 by 5	40 by 5d	W.
G. M. C., 101	5	.....	4½ by 5½	36 by 6	40 by 6d	W.

*2-cylinder. †6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield. Trac., tractor.

Final drive: W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel E., external gear. *Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

nd model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
	1½	$2,425	3¾ by 5	34 by 3½	34 by 5	W.
	2	3,250	4¼ by 5½	36 by 4	36 by 7	W.
	3½	4,450	4½ by 5½	36 by 5	36 by 5d	W.
	3½	4,500	4½ by 5½	36 by 6	36 by 6	W.
	3½-4	5,000	4½ by 6	36 by 6	36 by 6	W.
A	7	5,500	4½ by 6	36 by 6	36 by 10	W.
H	3	5,000	4½ by 6	36 by 6	36 by 6	W.
	4	5,500	4½ by 6	36 by 6	36 by 6	W.
	7	6,000	5¼ by 6	36 by 6	36 by 6	W.
	1½	2,195	3¾ by 5	35 by 5	36 by 6	I.
	1	1,495	3½ by 5	†33 by 5	†33 by 5	B.
	1½	2,050	3¾ by 5	36 by 3½	36 by 5	I.
	1½	2,725	3¾ by 5	36 by 3½	36 by 5	W.
	2	3,175	4¼ by 5½	36 by 4	36 by 7	W.
	2½	3,575	4½ by 5½	36 by 4	36 by 4d	W.
	3½	4,375	4½ by 5½	36 by 5	40 by 5d	W.
	5	5,275	4½ by 6	38 by 6	40 by 6d	W.
	1½	2,675	3½ by 5	†35 by 5	†38 by 7	I.
	1	.....	3½ by 5	36 by 3½	36 by 5	W.
	1½	.....	4¼ by 5½	36 by 3½	36 by 6	W.
	2	.....	4½ by 5½	36 by 4	36 by 7	W.
	2½	.....	4½ by 5½	36 by 4	36 by 8	W.
	3½	.....	4½ by 5½	36 by 5	36 by 10	W.
	5½	.....	4½ by 6	38 by 6	40 by 12	W.
	1	2,350	4 by 5	†35 by 5	†35 by 5	W.
	2½	3,250	4¼ by 5½	†35 by 5	38 by 7	W.
	2½	.....	4¼ by 5½	†36 by 4	†36 by 4d	W.
	3½	.....	4¼ by 5½	†36 by 5	†36 by 5d	W.
	5	.....	4¼ by 5½	36 by 5	40 by 6d	W.
	7	.....	4¼ by 5½	36 by 5	40 by 6d	C.
	1½	2,550	4¼ by 5½	34 by 3½	34 by 5	W.
	2½	3,300	4¼ by 5½	36 by 4	36 by 7	W.
	3½	4,300	4½ by 6	36 by 5	36 by 5d	W.
	5	5,200	4½ by 6	36 by 6	40 by 6d	W.
	1½	2,365	3¾ by 5½	*34 by 3½	*34 by 5	I.
	2	2,915	4¼ by 5½	*36 by 4	*36 by 6	I.
	3½	.....	4½ by 6	†*38 by 7	†*44 by 10	I.
	2½	3,300	4¼ by 5½	36 by 4	36 by 7	W.
	3½	4,200	4¼ by 5½	36 by 5	36 by 5d	W.
	5	5,400	5 by 6	36 by 6	40 by 6d	W.
	4	.....	4 by 6	36 by 5	36 by 6d	W.
	5	.....	4 by 6	36 by 5	40 by 6d	W.
	1	2,100	3½ by 5	35 by 5	35 by 5	W.
	1½	2,500	4¼ by 5½	34 by 5	36 by 6	W.
	1½	2,075	3¾ by 5	34 by 3½	34 by 6	W.
	1½	1,875	3 by 5½	34 by 3½	34 by 6	I.
	1½	2,850	4 by 5½	34 by 4	34 by 5	W.
	2½	3,750	4¼ by 5½	36 by 4	36 by 4d	W.
	2½	4,400	4½ by 6	36 by 5	36 by 5d	W.
	5	5,250	4½ by 6	36 by 5	40 by 6d	W.
E	1½	2,040	3¾ by 5½	34 by 3½	34 by 5	I.
F	2	2,495	4¼ by 5½	34 by 4	34 by 6	I.
F	1	1,885	3½ by 5	34 by 3½	34 by 4	W.
F	1½	2,770	3¾ by 5	36 by 3½	36 by 5	W.
H	2½	3,520	4¼ by 5½	36 by 4	36 by 4d	W.
K	3½	4,605	4½ by 5½	36 by 5	36 by 5d	W.
	1½	2,290	3¾ by 5½	34 by 3½	34 by 5	W.
	2	2,980	4¼ by 5½	36 by 4	36 by 7	W.
	2½	3,150	4¼ by 5½	36 by 4	36 by 8	W.
	3½	3,750	4½ by 5½	36 by 5	36 by 5d	W.
	5	4,795	5 by 6½	36 by 5	40 by 6d	W.
	1½	1,950	3¾ by 4½	†34 by 4	34 by 5	I.
	2	2,850	4 by 5	34 by 5	34 by 6	I.
	¾	1,850	3½ by 5½	36 by 3½	36 by 3½	I.
	1	2,050	3½ by 5½	36 by 3½	36 by 4	I.
	1½	2,400	3½ by 3½	36 by 3½	36 by 5	I.
	2	2,900	4 by 5	36 by 4	36 by 6	I.
	3½	4,500	4½ by 5	36 by 5	40 by 10	I.
	3½	4,250	4½ by 5½	36 by 7	36 by 7	I.
	1½	2,425	3¾ by 5½	36 by 3½	36 by 5	I.
	2	2,675	3¾ by 5½	†35 by 5	†38 by 7	I.
	2½	3,090	4¼ by 5½	36 by 4	36 by 7	I.
	3	3,590	4¼ by 5½	†36 by 6	†42 by 9	I.
	3½	4,080	4½ by 6	36 by 5	†36 by 10	I.

-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springtor.

, worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel; E., ires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

Name and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
Jumbo, 40	4	$4,730	4½ by 6	†38 by 7	44 by 10	I.
Jumbo Trac., C	5	3,170	4½ by 5½	36 by 4	36 by 10	I.
Jumbo, 35T	7	4,300	4½ by 6	36 by 5	36 by 10	I.
J. & J., D	2	3,250	4 by 5	34 by 4	36 by 6	I.
Kalamazoo, G1	1½	2,800	3½ by 5	34 by 4	34 by 5	W.
Kalamazoo	1½	3,100	3½ by 5	36 by 4	36 by 5	W.
Kalamazoo	2½	3,800	4 by 6	36 by 4	36 by 8	W.
Kalamazoo, K	3½	4,400	4½ by 6	36 by 5	36 by 10	W.
Karavan, A	3½	.....	4½ by 6	36 by 4	36 by 8	W.
Kearns, H	1	1,600	3½ by 4½	32 by 4½	32 by 4½	I.
Kearns, N	1½	2,200	3½ by 5	34 by 3½	34 by 6	I.
Keldon, 19	2	2,885	4½ by 5½	36 by 4	36 by 7	I.
Kelly-S., K-31	1½	3,000	3½ by 5½	36 by 3½	36 by 6	C.
Kelly-S., K-34	1½	3,000	3½ by 5½	36 by 3½	36 by 6	W.
Kelly-S., K-35	2½	3,500	3½ by 5½	36 by 4	36 by 8d	C.
Kelly-S., K-36	2½	3,500	3½ by 5½	36 by 4	36 by 8d	W.
Kelly-S., K-40	3½	4,400	4½ by 6½	36 by 5	40 by 8d	C.
Kelly-S., K-45	4	4,550	4½ by 6½	36 by 5	40 by 8d	C.
Kelly-S., K-50	5	5,150	4½ by 6½	36 by 6	40 by 8d	C.
Kelly-S., K-60	6	5,500	4½ by 6½	36 by 6	40 by 7d	C.
Kelly-S., K-41	3½	4,650	4½ by 6½	36 by 5	40 by 8d	I.
Kelly-S., K-42	3½	4,650	4½ by 6½	36 by 5	40 by 8d	W.
Keystone, 40	2	2,550	4½ by 5½	34 by 5	38 by 7	I.
Kimball, AB	2	3,675	4 by 6	36 by 4	36 by 7	W.
Kimball, AC	2½	3,975	4½ by 6	36 by 4	36 by 8	W.
Kimball, AK	3	4,400	4½ by 6	36 by 4	36 by 10	W.
Kimball, AE	4	4,975	4½ by 6	36 by 5	40 by 10	W.
Kimball, AF	5	5,975	5 by 6	36 by 6	40 by 12	W.
Kissel, Utility	1½	2,775	3½ by 5½	36 by 3½	36 by 5	W.
Kissel	2½	3,475	4½ by 5½	36 by 4	36 by 7	W.
Kissel, H. D	4	4,475	4½ by 5½	36 by 5	36 by 8d	W.
Kleiber, AA	1	2,600	3½ by 5½	34 by 3½	34 by 5	W.
Kleiber, A	1½	3,100	4½ by 5½	36 by 3½	36 by 6	W.
Kleiber, BB	2	3,600	4½ by 5½	36 by 4	36 by 7	W.
Kleiber, B	2½	4,200	4½ by 5	36 by 5	36 by 8	W.
Kleiber, C	3½	4,900	4½ by 5	36 by 5	36 by 10	W.
Kleiber, D	5	5,600	5½ by 5½	36 by 6	40 by 12	W.
Knox, 35	.....	6,000	5 by 5½	36 by 4	38 by 8d	C.
Knox, 36	.....	6,555	5 by 5½	36 by 4	38 by 8	
Koehler, C	1½	1,985	3½ by 5	34 by 3	34 by 5	I.
Koehler, M	2½	3,365	4 by 5½	36 by 4	36 by 7	W.
Koehler, MT	5	3,450	4 by 5½	36 by 4	36 by 7	W.
K-Z	1	2,250	3½ by 5	34 by 3½	34 by 5	W.
K-Z	1½	2,750	3½ by 5	36 by 4	36 by 6	W.
K-Z	2½	3,250	4½ by 5½	36 by 4	36 by 8	W.
K-Z	3½	4,250	4½ by 5½	36 by 5	40 by 10	W.
K-Z	5	5,200	4½ by 5½	36 by 6	40 by 8d	W.
Lange, B	2	3,000	4½ by 5½	36 by 4	36 by 6	C.
Larrabee, U	1½	2,400	3½ by 5	34 by 3½	34 by 5	W.
Larrabee, K	2½	3,400	4½ by 5½	36 by 4	36 by 7	W.
Larrabee, L	3½	4,200	4½ by 5½	36 by 5	36 by 8d	W.
Larrabee, W	5	5,100	4½ by 6	36 by 6	40 by 8d	W.
L. M. C., 2-20	2½	2,540	4½ by 5½	36 by 4	36 by 4d	I.
Lone Star	1½	1,745	3½ by 5	34 by 4	34 by 5	
Luedinghaus, K-S	2	2,790	4½ by 5½	*36 by 4	*36 by 7	W.
Luedinghaus, KL	2	2,890	4½ by 5½	36 by 4	*36 by 7	W.
Luedinghaus	1½	.....	3½ by 5½	34 by 3½	34 by 5	W.
Maccar, L	1½	2,925	4½ by 5½	36 by 4	36 by 6	W.
Maccar, H	2½	3,750	4½ by 5½	36 by 4	36 by 4d	W.
Maccar, M-2	3½	4,500	4½ by 6	36 by 5	36 by 8d	W.
Maccar, G	5	5,500	4½ by 6	36 by 5	40 by 8d	W.
Mack, AB	1½	3,450	4 by 5	36 by 4	36 by 3¼d	D.
Mack, AB	1½	3,000	4 by 5	36 by 4	36 by 3¼d	C.
Mack, AB	2	3,750	4 by 5	36 by 4	36 by 4d	C.
Mack, AB	2	3,300	4 by 5	36 by 4	36 by 4d	D.
Mack, AC	3½	4,950	5 by 6	36 by 5	40 by 8d	C.
Mack, AC	5	5,500	5 by 6	36 by 6	40 by 6d	C.
Mack, AC	6½	5,750	5 by 6	36 by 6	40 by 12	C.
Mack, AC	7½	6,000	5 by 6	36 by 7	40 by 7d	C.
Mack Trac., AB	5	3,400	4 by 5	36 by 4	36 by 4d	C.
Mack Trac., AC	7	4,950	5 by 6	36 by 5	40 by 8d	C.
Mack Trac., AC	10	5,500	5 by 6	36 by 6	40 by 6d	C.
Mack Trac., AC	13	5,750	5 by 6	36 by 6	40 by 12	C.
Mack Trac., AC	15	6,000	5 by 6	36 by 7	40 by 7d	C.

*2-cylinder. †6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield. Trac., tractor.

Final drive: W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel; I external gear. *Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

ıınd model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
.....	1½	$2,690	4¼ by 5½	34 by 3½	34 by 5	W.
.....	2½	3,290	4½ by 5½	34 by 4	36 by 7	D.
.....	2½	3,540	4½ by 5½	34 by 4	36 by 7	W.
.....	3½	4,190	4½ by 6	36 by 5	40 by 5d	W.
.....	3½	4,640	4½ by 6	36 by 5	40 by 5d	D.
.....	5	5,290	4½ by 6½	36 by 6	40 by 6d	W.
.....	5	5,440	4½ by 6½	36 by 6	40 by 6d	D.
.....	6	3,740	4½ by 5½	34 by 4	36 by 4d	D.
.....	1½	1,332	3½ by 4½	32 by 3	32 by 4	W.
.....	1	2,080	3½ by 5	34 by 3½	36 by 5	W.
.....	1½	2,725	4 by 5	36 by 3½	36 by 5	W.
.....	2	3,245	4 by 6	36 by 4	36 by 4d	W.
.....	3½	4,270	4½ by 6	36 by 5	36 by 5d	W.
.....	5	5,450	4½ by 6	36 by 6	40 by 6d	W.
.....	1½	2,250	3½ by 5	†34 by 5	†36 by 6	I.
.....	1	2,850	3½ by 5	†35 by 5	†36 by 6	W.
.....	1½	3,125	4¼ by 5½	36 by 3½	36 by 6	W.
.....	2½	3,900	4½ by 5½	36 by 4	36 by 8	W.
.....	4	4,975	4½ by 6	36 by 5	40 by 5d	W.
.....	5	5,350	4½ by 6	36 by 6	40 by 6d	W.
.....	2	2,325	4¼ by 5½	36 by 4	36 by 6	I.
.....	2	3,450	4 by 6	36 by 4	36 by 8	W.
.....	2½	4,150	4 by 6	†38 by 7	†42 by 9	W.
.....	1	1,535	3½ by 5	32 by 3½	34 by 4	I.
.....	1½	1,860	3½ by 5	32 by 4	34 by 5	I.
.....	1	1,895	3½ by 5½	34 by 3	34 by 4	I.
.....	2	2,550	3½ by 5½	34 by 4	34 by 6	I.
.....	2	3,250	4¼ by 5½	36 by 5	36 by 5	I.
.....	1½	.....	4¼ by 5½	36 by 3½	36 by 5	W.
.....	2	.....	4¼ by 5½	36 by 4	36 by 7	W.
.....	3½	.....	4¼ by 5½	36 by 5	36 by 5d	W.
.....	5	.....	4½ by 6	36 by 6	40 by 6d	W.
.....	2	3,100	4¼ by 5½	36 by 4	36 by 7	W.
.....	2½	3,500	4¼ by 5½	36 by 4	36 by 8	W.
.....	1½	3,100	4¼ by 5½	36 by 3½	36 by 5	W.
.....	2–2½	3,300	4¼ by 5½	36 by 4	36 by 4d	W.
.....	2	3,000	4¼ by 5½	36 by 4	36 by 7	W.
.....	1	.....	3½ by 5½	36 by 3½	36 by 4	W.
.....	1½	.....	3½ by 5½	36 by 3½	36 by 5	W.
.....	2	.....	4 by 5½	36 by 4	36 by 7	W.
.....	2½	.....	4½ by 5½	36 by 4	36 by 8	W.
.....	3½	.....	4½ by 6	36 by 5	36 by 10	W.
.....	2	3,400	4 by 6	36 by 4	36 by 4d	W.
.....	3½	4,400	4 by 6	36 by 5	40 by 5d	W.
.....	1	1,695	3½ by 5	34 by 3½	34 by 4	W.
.....	1½	2,025	3½ by 5	34 by 3½	34 by 5	W.
.....	1½	2,350	3½ by 5	36 by 3½	36 by 5	W.
.....	2½	2,900	4¼ by 5	36 by 4	36 by 8	W.
.....	1½	2,675	4 by 5½	36 by 3½	36 by 5	W.
.....	2½	3,450	4¼ by 5½	36 by 4	36 by 8	W.
.....	3½	4,250	4¼ by 6	36 by 5	36 by 10	W.
.....	1	2,175	3½ by 5	36 by 3½	36 by 4	W.
.....	1½	2,350	4 by 5	34 by 4	36 by 6	W.
.....	2½	3,500	4¼ by 6	34 by 4	36 by 4d	W.
.....	3½	4,250	4¼ by 6	36 by 5	36 by 5d	W.
.....	5	5,250	4¼ by 6	36 by 6	40 by 6d	W.
.....	7½	6,250	4½ by 6½	36 by 6	40 by 7d	C.
.....	1	1,500	3 11/16 by 5½	†35 by 5	†35 by 5	I.
.....	1½	2,350	3½ by 5½	36 by 3½	36 by 5	W.
.....	1½	2,915	4 by 5½	36 by 3½	36 by 6	W.
.....	2½	3,390	4 by 5½	36 by 4	36 by 7	W.
.....	3½	4,345	4½ by 5½	36 by 5	36 by 10	W.
.....	5	5,460	4½ by 5½	36 by 6	40 by 12	W.
.....	1½	2,750	3½ by 5½	36 by 3½	36 by 5	W.
.....	2½	3,250	4 by 5½	36 by 4	36 by 7	W.
.....	3½	4,150	4¼ by 5½	36 by 5	36 by 8	W.
.....	2	3,750	3½ by 5	†36 by 6	†36 by 6	4.
.....	2	3,850	3½ by 5	†36 by 6	†36 by 6	4.
.....	.....	3,850	4 1/16 by 5½	36 by 3½	36 by 6	W.
.....	.....	4,900	4½ by 5½	36 by 5	36 by 5	W.
.....	.....	5,950	5 by 5½	36 by 6	40 by 6	W.
.....	.....	4,650	4 1/16 by 5½	†36 by 6	†40 by 8	W.
.....	.....	6,050	5 by 5½	†38 by 7	†44 by 10	W.
.....	2½	3,635	4½ by 5½	34 by 4	34 by 4d	W.

‡-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield.

W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel.

*Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

Name and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
Paige, 51-18	3½	$4,385	4½ by 5½	36 by 5	36 by 5d	W.
Parker, F20	2	3,500	4 by 6	34 by 4	36 by 4d	W.
Parker, F20	3½	4,400	4½ by 6	36 by 5	40 by 5d	W.
Parker, M20	5	.....	4½ by 6	36 by 6	40 by 6d	W.
Piedmont, 4-30	1½	1,785	3½ by 5	34 by 4	34 by 4	W.
Pierce-Arrow	2	3,750	4 by 5½	36 by 4	36 by 4d	W.
Pierce-Arrow	3½	4,950	4½ by 6½	36 by 5	36 by 5d	W.
Pierce-Arrow	5	5,700	4½ by 6½	36 by 5	40 by 6	W.
Pioneer, B	1	2,190	3½ by 5½	36 by 3	36 by 5	W.
Pioneer, N	1½	2,790	3½ by 5½	36 by 3½	36 by 6	W.
Pioneer, F	2	3,190	4½ by 5½	36 by 4	36 by 7	W.
Pioneer, A	3½	4,190	4½ by 5½	36 by 5	36 by 5d	W.
Pioneer, J	5	4,990	4½ by 5½	36 by 6	40 by 6d	W.
Pittsburger, B	2½	.....	4½ by 5½	36 by 5	36 by 7	W.
Pony	½	320	2½ by 4	†28 by 3	†28 by 3	C.
Power, F	1½	.....	3½ by 5½	36 by 6	36 by 6	
Power, C	3½	.....	4½ by 5½	36 by 5	40 by 10	W.
Rainier, R-11	½	2,150	3½ by 5	35 by 5	35 by 5	W.
Rainier, R-9	1	2,350	3½ by 5	32 by 3	32 by 4	W.
Rainier, R-6	1½	2,450	3½ by 5	34 by 3	34 by 4	W.
Rainier, R-8	2	2,900	3½ by 5	34 by 5	34 by 6	W.
Ranger, C	2	2,575	3½ by 5	*34 by 3½	*34 by 5	W.
Reo, F	1½	1,385	4⅛ by 4½	†34 by 4½	†34 by 4½	B.
Reliance, 10A	1½	2,500	4 by 5½	36 by 3½	36 by 5	L.
Reliance, 10B	2	2,825	4 by 5½	†36 by 6	38 by 7	L.
Reliance, 20B	2½	3,200	4½ by 5½	36 by 4	36 by 4d	L.
Reliance, 20C	2½	3,675	4½ by 5½	†36 by 6	42 by 9	L.
Republic, 10	1	1,655	3½ by 5	34 by 3	34 by 4	L.
Republic, 11X	1½	2,195	3½ by 5	31 by 3½	34 by 5	L.
Republic, 19	2½	2,795	4⅛ by 5½	36 by 4	36 by 7	L.
Republic, 20	3½	3,845	4½ by 5½	36 by 5	36 by 10	L.
Riker, B	2	4,600	4½ by 6	36 by 5	36 by 5d	W.
Riker, BB	4	4,700	4½ by 6	36 by 5	36 by 6d	W.
Rock Falls, 9	1½	.....	†3½ by 5½	†35 by 5	†35 by 5	B.
Rowe, CW	1½	2,800	3½ by 5	†36 by 6	†36 by 6	W.
Rowe, HW	4	4,500	4½ by 6	36 by 5	36 by 6d	W.
Rowe, C. D. W	2	3,300	4 by 5	34 by 4	36 by 3½d	W.
Rowe, G. S. W	3	4,150	4 by 6	34 by 5	36 by 5d	W.
Rowe, G. P. W	3	5,250	‡3½ by 5	†38 by 7	†42 by 9	W.
Rowe, F. W	5	5,500	4½ by 6	36 by 6	40 by 6d	W.
Rumely	1½	.....	3½ by 5½	36 by 3½	36 by 5	W.
Samson, 15	½	895	.....	32 by 4	32 by 4	B.
Samson, 25	1½	1,185	.....	35 by 5	35 by 5	B.
Sandow, G	1	2,195	3½ by 5	34 by 3½	34 by 5	W.
Sandow, I	2	2,575	3½ by 5	36 by 4	36 by 6	B.
Sandow, CG	1½	2,490	3½ by 5	34 by 3½	34 by 5	W.
Sandow, J	2½	3,175	4½ by 5½	36 by 4	36 by 7	W.
Sandow, M	3½	4,095	4½ by 5½	36 by 5	36 by 5d	W.
Sandow, L	5	4,775	4½ by 5½	36 by 6	40 by 6d	W.
Sanford, 25	2½	3,350	4½ by 5½	36 by 4	36 by 4d	W.
Sanford, 35	3½	4,200	4½ by 5½	36 by 5	36 by 5d	W.
Sanford, 50	5	5,100	4½ by 5½	36 by 5	40 by 6d	W.
Schacht, 2-ton	2	.....	4½ by 5½	36 by 4	36 by 7	W.
Schacht, 2½-ton	2½	.....	4½ by 5½	36 by 4	36 by 4d	W.
Schacht, 3½-ton	3½	.....	4½ by 6	36 by 5	36 by 5d	W.
Schacht, 5-ton	5	.....	4½ by 6	36 by 5	40 by 6d	W.
Schwartz, B2	2	2,600	3½ by 5½	34 by 3½	34 by 6	W.
Schwartz, C2	3	3,200	4½ by 5½	36 by 4	36 by 8	W.
Schwartz, D	5	4,900	4½ by 6	36 by 5	40 by 6d	W.
Selden, 1½ A	1½	2,360	3½ by 5	34 by 3½	35 by 5	W.
Selden, 2½ A	2½	3,425	4½ by 5½	36 by 4	36 by 7	W.
Selden, 3½ A	3½	4,175	4½ by 5½	36 by 5	36 by 10	W.
Selden, 5A	5	5,600	4½ by 6	36 by 6	40 by 12	W.
Seneca, M	½	1,160	3½ by 4½	30 by 3½	†30 by 3½	B.
Service, 20	1	2,415	3½ by 5½	34 by 3½	34 by 5	W.
Service, 31	1½	2,985	4 by 5½	36 by 3½	36 by 6	W.
Service, 36	1½	3,415	4½ by 5½	†35 by 5	†38 by 7	W.
Service, 51	2½	3,475	4½ by 5½	36 by 4	36 by 7	W.
Service, 71	3½	4,285	4½ by 5½	36 by 5	38 by 5d	W.
Service, 76	3½	4,485	4½ by 6	36 by 5	36 by 5d	W.
Service, 101	5	5,275	4½ by 6	36 by 6	40 by 6d	W.
Shaw, M2	½	2,050	3½ by 5	32 by 4	32 by 4	B.
Shaw, M4	1	2,450	3½ by 5	34 by 4½	34 by 4½	W.
Signal, F	1	2,475	4½ by 5	†34 by 5	†36 by 6	W.

*2-cylinder. †6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield. Trac., tractor.

Final drive: W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel; E., external gear. *Tires, optional. †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

ne and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
	1½	$2,925	4½ by 5½	34 by 4	36 by 6	W.
	2½	3,275	4½ by 5½	31 by 4	36 by 8	W.
	3½	4,275	4½ by 5½	36 by 5	40 by 10	W.
	5	5,300	4½ by 6	36 by 6	40 by 12	W.
	1	1,990	3¼ by 5½	34 by 3½	34 by 4	W.
	1½	2,500	3¾ by 5	34 by 4½	34 by 5	W.
	2	2,890	4 by 5½	36 by 4	36 by 7	W.
-K	1	2,250	3¼ by 5	34 by 3½	34 by 4	W.
	2½	3,100	4½ by 5½	36 by 4	36 by 7	W.
	3½	4,000	4½ by 5½	36 by 5	36 by 5d	W.
	5	4,800	4½ by 5½	36 by 6	40 by 6d	W.
	1½	.....	4 by 5½	36 by 3½	36 by 5	W.
	2	.....	4 by 5½	36 by 4	36 by 6	W.
	2½	.....	4½ by 5½	36 by 4	36 by 7	W.
	3½	.....	4½ by 6½	36 by 5	40 by 5d	W.
	5	.....	5 by 6½	36 by 6	40 by 6d	W.
	5	.....	5 by 6½	36 by 6	40 by 6d	C.
	7½	.....	5 by 6½	36 by 6	40 by 7d	C.
	¾	1,295	3½ by 4½	†32 by 4	†32 by 4	I.
	1	1,650	3¾ by 5	34 by 3½	34 by 4	I.
	1½	1,995	3¾ by 5	34 by 3½	34 by 5	I.
	2	2,495	4½ by 5½	34 by 4	34 by 7	I.
	2½	2,575	4½ by 5½	34 by 4	34 by 7	I.
	3½	3,395	4½ by 5½	36 by 5	36 by 5d	I.
	1½	2,350	3¾ by 5½	36 by 3½	36 by 5	W.
	2	2,800	4 by 5½	36 by 4	36 by 7	W.
	3	3,600	4½ by 5½	36 by 4	36 by 5d	W.
	2½	2,850	4½ by 5	34 by 4	36 by 7	W.
	1½	2,350	3¼ by 4½	36 by 4	36 by 5	W.
	2	3,350	4½ by 5½	36 by 4	36 by 7	W.
	3½	4,650	4½ by 6	36 by 5	36 by 5d	W.
	1	1,800	3¼ by 5	†34 by 4½	34 by 4	I.
	2	2,750	4½ by 5½	36 by 4	36 by 6	I.
50	2½	.....	4 by 6	36 by 4	36 by 8	W.
70	3½	.....	4½ by 6	36 by 5	40 by 5d	W.
100	5	.....	4¾ by 6	36 by 5	40 by 6d	W.
150	7½	.....	5 by 6	36 by 6	40 by 7d	W.
	¾	.....	3¼ by 5	33 by 4	33 by 4	I.
	1½	.....	3¼ by 5	36 by 6	38 by 7	W.
	1½	.....	3½ by 5	†36 by 6	†38 by 7	
	1½	2,695	4½ by 5½	36 by 3½	36 by 5	W.
	2½	3,580	4½ by 5½	36 by 4	36 by 3½d	W.
	3½	4,760	4½ by 5½	36 by 5	36 by 5d	W.
	5	5,850	4¾ by 6	36 by 6	40 by 6d	W.
	6	6,050	4½ by 6	36 by 6	40 by 12	W.
ort	3½	4,550	4½ by 6	36 by 5	40 by 5d	I.
	6	5,400	4½ by 6	36 by 5	40 by 6d	I.
	2½	3,400	4½ by 5½	34 by 4	36 by 4d	I.
	1½	3,000	4½ by 5½	35 by 5	38 by 7	W.
	2½	3,475	4½ by 5½	36 by 4	36 by 7	W.
	3½	4,400	4½ by 5½	36 by 5	36 by 5	W.
	2	1,595	3¾ by 5	*34 by 3½	*34 by 5	I.
	1	1,850	3¾ by 5	34 by 3½	34 by 4	I.
	1½	2,250	3¾ by 6	36 by 3½	36 by 5	I.
	2½	2,785	4½ by 5½	36 by 4	36 by 7	I.
	3½	4,195	4½ by 6	36 by 5	36 by 10	I.
	1½	2,075	3¾ by 5½	34 by 3½	34 by 5	W.
	2	2,875	4 by 5½	3 by 04	36 by 7	W.
	3	3,375	4½ by 5½	36 by 4	36 by 8	W.
	¾	1,600	3½ by 5	†35 by 5	†35 by 5	I.
	1½	2,350	3¾ by 5½	34 by 3½	34 by 6	I.
	2	2,700	3¾ by 5½	36 by 4	36 by 6	I.
	2½	2,950	4 by 5½	36 by 4	36 by 7	I.
	1½	2,400	3¾ by 5½	36 by 3½	36 by 5	W.
	2	2,900	3¾ by 5½	36 by 4	36 by 7	W.
	3½	4,750	5½ by 6	36 by 6	36 by 6	I.
	5	5,250	5½ by 6	36 by 7	36 by 7	I.
	2	3,200	4 by 5½	36 by 3½	36 by 5	W.
	2	3,450	4½ by 5½	†35 by 5	36 by 5	W.
BL	3	3,750	4½ by 5½	36 by 4	36 by 4d	W.
	2½	3,150	4 by 6	36 by 5	36 by 8	I.
	4	3,975	4½ by 6	36 by 6	36 by 10	I.
	6	5,400	5 by 6	36 by 6	40 by 14	I.
	1½	2,445	3¼ by 5½	36 by 3½	34 by 5	I.

†6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield tractor.

W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel; E., electric.

*Tires, optional; †pneumatic tires. All others solid.

Specifications of current motor truck models—Continued.

Name and model.	Tons capacity.	Chassis price.	Bore and stroke.	Tires.		Final drive.
				Front.	Rear.	
United, B	2½	$3,150	4½ by 5½	36 by 4	36 by 7	I.
United, C	3½	3,975	4½ by 5½	36 by 5	36 by 5d	I.
United, V	5	5,100	4½ by 6	36 by 6	40 by 6d	I.
U. S., N	1½	.....	3½ by 5	36 by 3½	36 by 5	I.
U. S., NC	2	.....	3½ by 5	†35 by 5	†38 by 7	I.
U. S., NW	1½	.....	3½ by 5	36 by 3½	36 by 5	W.
U. S., NP	2	.....	3½ by 5	†35 by 5	†38 by 7	W.
U. S., R	3	.....	4 by 5½	36 by 4	36 by 4d	W.
U. S., S	4	.....	4½ by 5½	36 by 5	36 by 5d	W.
U. S., T	5–6	.....	4½ by 6½	36 by 6	40 by 6d	W.
Velie, 46	1½	1,925	3½ by 5	36 by 3½	36 by 5	I.
Victor, A	1½	2,050	3½ by 5	34 by 4	34 by 5	I.
Victor, B	2	2,225	3½ by 5	34 by 4	34 by 5	I.
Vim 29	½	1,355	3½ by 4½	†31 by 4	†31 by 4	W.
Vim 30	½	1,550	3½ by 4½	†32 by 4½	†32 by 4½	W.
Vim 31	1	2,475	3½ by 5½	†35 by 5	†36 by 5	W.
Vim, 22	2	3,150	3½ by 5½	36 by 4	36 by 6	W.
Vim, 23	3	3,950	4½ by 5½	36 by 5	36 by 5d	W.
Walker-Johnson	2½	3,450	4½ by 5½	36 by 4	36 by 8	W.
Walter, 8	5	5,000	4½ by 6½	36 by 6	40 by 6d	D.
Ward-LaF., 2B	2½	3,590	4½ by 5½	*36 by 4	*36 by 7	W.
Ward-LaF., 4A	3½	4,690	4½ by 6½	*36 by 5	*36 by 5d	W.
Ward-LaF., 5A	5	5,590	5 by 6½	36 by 6	40 by 6d	W.
Watson, 3½	3½	.....	4½ by 5½	36 by 5	36 by 10	W.
White, 15	½	2,400	3½ by 5½	†34 by 4½	†34 by 4½	B.
White, 20	2	3,300	3½ by 5½	*36 by 4	*36 by 7	D.
White, 40	3	4,500	3½ by 5½	36 by 5	40 by 5d	D.
White, 45	5	5,000	4½ by 5½	36 by 6	40 by 6d	D.
White Hick., E	1	.....	3½ by 5	†35 by 5	†35 by 5	W.
White Hick., H	1½	.....	3½ by 5	36 by 3½	36 by 5	W.
White Hick., K	2½	.....	4½ by 5½	36 by 4	36 by 7	W.
Wichita, K	1	2,300	3½ by 5	36 by 3	36 by 4	W.
Wichita, L	1½	2,600	3½ by 5½	36 by 3½	36 by 5	W.
Wichita, M	2	2,800	3½ by 5½	36 by 3½	36 by 6	W.
Wichita, R	2½	3,000	3½ by 5½	36 by 4	36 by 7	W.
Wichita, RX	2½	3,600	4½ by 6	36 by 4	36 by 7	W.
Wichita, O	3½	4,000	4½ by 6	36 by 5	36 by 5d	W.
Wichita, S	5	5,000	4½ by 6	36 by 6	40 by 6d	W.
Wilcox, A-1	1	.....	3½ by 5½	†35 by 5	†35 by 5	W.
Wilcox, B	1½	.....	4½ by 5	36 by 4	36 by 5	W.
Wilcox, C	2½	.....	4½ by 6	36 by 4	36 by 3½d	W.
Wilcox, E	3½	.....	4½ by 5	36 by 5	36 by 5d	W.
Wilcox, F	5	.....	4½ by 6½	36 by 5	40 by 6d	W.
Wilson, F	1¼	2,650	3½ by 5	36 by 3½	36 by 5	W.
Wilson, EA	2½	3,300	4½ by 5½	36 by 4	36 by 7	W.
Wilson, G	3½	4,300	4½ by 5½	36 by 5	36 by 5d	W.
Wilson, H	5	5,275	4½ by 5½	36 by 6	40 by 6d	W.
Winther, 751	½	1,795	3½ by 5	34 by 4½	35 by 5	I.
Winther, 430	1½	2,850	3½ by 5	32 by 4	32 by 4	I.
Winther, 39	1½	2,450	3½ by 5	34 by 3½	34 by 5	I.
Winther, 49	2	3,250	4 by 5	34 by 4	34 by 4d	I.
Winther, 450	2½	3,680	4 by 5	34 by 5	36 by 6	I.
Winther, 70	3½	4,200	4 by 6	36 by 5	36 by 5d	I.
Winther, 109	5	5,250	4½ by 6	36 by 5	40 by 6d	I.
Winther, 140	7	5,900	5 by 6	36 by 6	40 by 7d	I.
Witt-Will, N	1½	2,450	4½ by 5½	36 by 3½	36 by 5	W.
Witt-Will, P	2½	3,250	4½ by 5½	36 by 4	36 by 7	W.
Wolverine, C	1½	2,790	3½ by 5½	34 by 3½	34 by 5	I.
Wolverine, D	2	2,650	3½ by 5½	34 by 4	34 by 7	I.

*2-cylinder. †6-cylinder. ‡8-cylinder. All others, not marked, are 4-cylinder. Kelly-S., Kelly-Springfield. Trac., tractor.

Final drive: W., worm; I., internal gear; C., chains; D., double reduction; B., bevel; 4, four-wheel E., external gear. *Tires, optional; † pneumatic tires. All others solid.

Farm tractor specifications and prices.[1]

: G, gasoline; K, kerosene; D, distillate. Plow capacity varies in relation to operating con-
gures are based on 14-inch plows. LeR., LeRoi. Clim., Climax. Beav., Beaver. Dom.,
nt., Continental. Wauk., Waukesha. Wisc., Wisconsin. T. C., Twin City. Vur.,
n., Evinrude. Midw., Midwest. Com., Commercial tractor. * Crawler type. All others
pe.

ıame.	Rating.	Price.	Wheels or crawlers.	Engine.	Cylinders, bore, stroke.	Fuel.	Plow capacity.
.....	6-12	.....	2	LeR.....	4- 3¼ by 4½	Gas.....	1-2
.....	10-18	.....	3	Own.....	2- 5½ by 7	G, K.....	2-3
.....	18-30	.....	4	Own.....	4- 4½ by 6½	G, K.....	3-4
.....	12-25	.....	4	Own.....	4- 4½ by 6	G or K....	3
.....	14-28	.....	4	Own.....	4- 5 by 6	G, K.....	3
D.....	18-36	.....	4	Clim.....	4- 5 by 6½	G or K....	4
.....	12-20	$1,500	4	Buda.....	4- 4¼ by 5½	G, K.....	2-3
.....	15-30	.....	4	Clim.....	4- 5 by 6½	G, K.....	4
.....	22-45	.....	4	Own.....	4- 5½ by 8	G, K.....	6
.....	30-60	.....	4	Own.....	4- 7 by 9	G, K, D...	8
.....	12-24	.....	4	Herc'ls....	4- 4 by 5½	G, K.....	2-3
il.....	5-10	.....	4	Own.....	4- 3 by 4	G, K.....	.....
.....	.....	.....	3	Own.....	6- 3 by 4	G, K.....	.....
.....	.....	.....	3	Own.....	6- 3 by 4	G, K.....	.....
.....	5-10	.....	4	Own.....	4- 3 by 4	G, K.....	2
.....	.....	.....	4	Own.....	6- 3 by 4	G, K.....	2
.....	8-16	.....	4	Own.....	2- 5½ by 6	G, K, D...	2-3
.....	12-25	.....	4	Own.....	2- 6½ by 7	G, K, D...	3-4
.....	14-28	.....	4	Own.....	4- 4½ by 7	G, K, D...	3-4
.....	18-36	.....	4	Own.....	4- 5½ by 6	G, K, D...	4-5
.....	25-50	.....	4	Own.....	4- 6½ by 7	G, K, D...	5-6
.....	45-65	.....	4	Own.....	4- 7½ by 8	G, K, D...	8-10
.....	15-25	.....	4	Own.....	4- 4½ by 6	Ker.....	3
.....	15-22	.....	*4	Own.....	1- 4½ by 6	G, K, D...	3
.....	8-16	.....	*1	Own.....	14- 3½ by 4	G, K.....	2-3
.....	2- 4	340	2	Own.....	1- 3½ by 4½	Gas.....	½
.....	30	3,250	*2	Own.....	4- 4½ by 6½	G, K, D...	4
.....	35-60	5,750	*2	Own.....	4- 6½ by 8½	G, K, D...	8-1
.....	12-24	1,200	3	Toro.....	2- 5½ by 7	G, K.....	3
.....	15-30	1,650	4	Own.....	2- 6½ by 7	Ker.....	3
.....	15-30	1,500	2	Own.....	4-4½ by 6	Gas.....	33
.....	10-18	1,200	4	Own.....	4- 3½ by 5	G, K, D...	2-3
.....	15-27	1,800	4	Own.....	4- 4½ by 6	G, K, D...	3-4
.....	22-40	3,100	4	Own.....	4- 5½ by 6½	G, K, D...	4-5
.....	25-40	.....	*2	Own.....	4- 4½ by 6	Gas.....	4
.....	40-60	.....	*2	Own.....	4- 6½ by 7	Gas.....	6
.....	12-25	1,785	3	Buda.....	4- 4½ by 5½	G, K, D...	2-3
.....	12-20	1,495	*2	Own.....	4- 4 by 5½	G, K, D...	2-3
.....	15-27	1,750	3	Dom.....	4- 4½ by 6	G, K.....	3
.....	15-30	2,000	4	Buda.....	4- 4½ by 6	Gas.....	3-4
.....	20	2,480	4	Cont.....	4- 4½ by 5½	Gas.....	3
.....	12-22	1,390	4	Own.....	2- 7 by 8	Ker.....	3
.....	16-30	1,850	4	Own.....	2- 8 by 8	Ker.....	4
.....	12-20	.....	4	Own.....	1- 4½ by 5	Ker.....	3
.....	12-20	.....	4	Own.....	4- 5½ by 5	Ker.....	3
.....	16-32	.....	4	Own.....	4- 5½ by 7	Ker.....	4
.....	40-65	.....	4	Own.....	4- 7½ by 9	Ker.....	8-10
.....	18-30	2,000	4	Buda.....	4- 4½ by 6	G, K.....	4
.....	9-12	1,525	4	Lye.....	4- 3½ by 5	G, K, D...	2
.....	18-30	1,685	4	Clim.....	4- 5 by 6½	G, K.....	3-4
.....	15-25	.....	3	Buda.....	4- 4½ by 6	G, K, D...	3-4
.....	18-35	.....	4	Own.....	4- 6 by 8	G, K.....	4-5
.....	25-50	.....	4	Own.....	4- 7 by 8	G, K.....	6-7
.....	20-35	.....	4	Clim.....	4- 5 by 6½	G, K, D...	3-4
.....	20-35	.....	4	Own.....	4- 5½ by 6	Ker.....	4-6
.....	30-50	.....	4	Own.....	4- 6½ by 7	Ker.....	6-8
.....	40-70	.....	4	Own.....	4- 7½ by 9	Ker.....	8-1
.....	18	790	4	Own.....	4- 4 by 5	G, K.....	2
.....	15-25	2,085	*2	Erd.....	4- 4½ by 6	G or K....	2-3
C.....	18-30	2,750	*2	Clim.....	4- 4½ by 6	G or K....	3
G.....	18-30	3,850	*2	Clim.....	4- 4½ by 6	G or K....	Com.
.....	12-20	.....	4	Erd.....	4- 4 by 6	G, K.....	3
.....	15-28	.....	4	Beav.....	4- 3¾ by 6	G, K.....	3-4
.....	14-28	1,485	4	Wauk.....	4- 4¼ by 5½	Ker.....	3
.....	18-36	2,500	4	Wauk.....	4- 4½ by 6½	G or K....	4
.....	18-36	.....	3	Wauk.....	4- 4½ by 6½	G, K.....	4
.....	.....	2,800	4	.....	4- 4 by 6	Ker.....	4
t.....	20-30	1,950	4	Beav.....	4¾ by 6	K.....	4
.....	30	1,495	4	Own.....	2- 6½ by 7	K, D.....	3
.....	9-16	.....	4	Wauk.....	4- 4½ by 5½	G, K.....	2
.....	12-20	.....	4	Wauk.....	4- 4½ by 6½	G, K.....	3
.....	6-10	.....	4	LeR.....	4- 3¼ by 4½	Gas.....	1
.....	15-30	1,750	4	.....	4- 4½ by 6	K or G....	4
.....	12-25	1,385	4	Wauk.....	4- 4½ by 5½	G, K, D...	3

ld, Dec. 4, 1920.

Farm tractor specifications and prices—Continued.

Trade name.	Rating.	Price.	Wheels or crawlers.	Engine.	Cylinders, bore, stroke.	Fuel.	Plow capacit
Illinois, C	18-36	$2,375	4	Clim	4- 5 by 6½	G,K	
Imperial, 40	40-70	5,000	4	Own	4- 7½ by 9	G,K,D	
Indiana	5-10		2	LeR	4- 3½ by 4	Gas	
International	8-16		4	Own	4- 4½ by 5	G,K,D	
International	15-30		4	Own	4- 5½ by 8	G,K,D	
J-T, N	16-30		*2	Chief	4- 4½ by 6	G,K	
Kardel Util	12-25	1,650	4	Midw	4- 4½ by 5½	G or K	
Keck-Gon	15-30	1,650	4	Own	2- 7½ by 8	G,K	
Klumb, F	16-32		4	Clim	4- 5 by 6½		
LaCrosse, M	7-12	950	4	Own	2- 4 by 6	G,K	
LaCrosse, G	12-24	1,250	4	Own	2- 6 by 7	Ker	
Lauson	15-25		4	Beav	4- 4½ by 6	G,K,D	
Lauson	15-30		4	Beav	4- 4½ by 6	G,K,D	
Lauson Road	15-30		4	Beav	4- 4½ by 6	G,K,D	
Leader, B	12-20		4	Own	2- 6 by 6½	G,K,D	
Leader, N	16-32		4	Clim	4- 5 by 6½	G,K	
Leader, C	18-36		4	Clim	4- 5 by 7½	G,K,D	
Leonard, E	20-30	2,530	4	Buda	4- 4½ by 6	G,K	
Liberty	18-32	2,475	4	Clim	4- 5 by 6½	G,K	
Little Bear	4	850	4	Ford	4- 3⅜ by 4	Gas	
Little Giant, B	16-22	2,200	4		4- 4½ by 5	K	
Little Giant, A	28-35	3,300	4		4- 5½ by 6	K	
Lombard	85-150		*2	Own	4- 5¾ by 6½	Gas	
Manultivator	14	225	2		1- 2⅞ by 3½	Gas	
Magnet	14-28		4	Wauk	4- 4½ by 6½		
Market	2-4½			Var	1- 4 by 4	Gas	
Master Jr	4- 8			LeR	2⅜ by 4	Gas	
Merry Gar	2	230	2	Evin	1- 2⅜ by 2½	Gas	
Minne, All-P	12-25	1,325	4	Own	4- 4½ by 7	G or K	
Mohawk	8-16	785	2		4- 3½ by 4½	K or G	
Moline Univ	9-18	1,325	2	Own	4- 3½ by 5	Gas	
Moline Orch	9-18	1,375	2	Own	4- 3½ by 5	Gas	
Monarch	30-18	3,250	*2	Beav	4- 4½ by 6	Ker	
Motox	15-30	2,250	4	Buda	4- 4½ by 6	Gas	
New Britain, 1	3- 6	450		Own	2- 3½ by 4	Gas	
New Britain, 2	3- 6	500		Own	2- 3½ by 4	Gas	
Nilson Spec	10-20		4	Wauk	4- 3½ by 5½	Gas	
Nilson Senior	20-40	2,675	5	Wauk	4- 5 by 6½	G,K	
Oil Pull	12-20		4	Own	2- 6 by 8	K,D	
Oil Pull	15-30		4	Own	2- 7 by 8½	K,D	
Oil Pull	20-40		4	Own	2- 8 by 10	K,D	
Oil Pull	30-60		4	Own	2-10 by 12	K,D	
Oldsmar	1½- 5	395	2	Own	1- 5½ by 5½	Gas	
Oliver	15-30	3,500	*2	Beav	4½ by 6	G or K	
Parrett, K	15-30		4	Par	4- 4½ by 6	G,K	
Peoria, L	12-25	1,785	4	Clim	4- 5 by 6½	G,K	
Pioneer, G	18-36		4	Own	4- 5½ by 6	Ker	
Pioneer, C	30-60		4	Own	4- 7 by 8	G	
Plowman	15-30	1,995	4	Buda	4- 4½ by 6	G,K	
Port Huron, A	12-25	1,700	4	Chief	4- 4¾ by 6	G,K	
Post	12-20		4	Wauk	4- 4½ by 5¾	G or K	
Prairie Dog, L	9-18		3	Wauk	4- 3¾ by 5½	Gas	
Prairie Dog, D	15-30		4	Wauk	4- 4½ by 6½	Gas	
Ranger Cult	8-16	1,250	4	LeR	4- 3¾ by 4½	Gas	
Reed	15-30	2,185	4	Dom	4- 4½ by 6	K	
Reliable	10-20	985	4	Own	2- 6 by 7	G,K,D	
Samson			4	Own	4- by	G,K	
Sandusky, J	10-20	1,250	4	Own	4- 4½ by 5½	G,K,D	
Sandusky, E	15-35	1,750	4	Own	4- 5 by 6½	G,K,D	
Shawnee	6-12		2	LeR	4- 3¾ by 4¾		
Shawnee	9-18		2	Gray	4- 3¾ by 5		
Shelby, C	9-18		4	Wauk	4- 3¾ by 5½	Gas	
Shelby, D	15-30		4	Beav	4- 4½ by 6	G,K	
Short Turn	20-40	1,500	3		4- 4¾ by 6	G,K	
Square T	18-35		3	Clim	4- 5 by 6½	K,G	
Steady Pull	12-24	1,185	4		4- 4 by 5	Gas	
Stinson, 4E	18-36		4	Beav	4- 4¾ by 6	G,K	
Stone	20-40		4	Beav		G,K	
Tioga	15-27	2,625		Wisc	4- 4¾ by 6	G,K	
Titan	10-20		4	Own	2- 6½ by 8	G,K,D	
Tillermo, A	2- 6	385		Var	1- 4 by 4	G,K	
Topp, B	30-45	4,000	4	Wauk	4- 4¾ by 6¾	Gas	
Toro	6-12	950	4	LeR	4- 3¾ by 4½	Gas	
Traylor	6-12	815	4	LeR	4- 3¾ by 4½	Gas	
Triumph, H	18-36	2,450	4	Erd	4- 4¾ by 6	Ker	
Turner	14-25		4	Buda	4- 4½ by 5½	G,K	
Twin City	12-20		4	Own	4- 4½ by 6	G,K	
Twin City	20-35		4	Own	4- 5½ by 6½	G,K	
Twin City	40-65		4	Own	4- 7½ by 9	G,K	
Uncle Sam	10-18	1,485	4	Wid	4- 4 by 5½	Ker	

Farm tractor specifications and prices—Continued.

ıme.	Rating.	Price.	Wheels or crawlers.	Engine.	Cylinders, bore, stroke.	Fuel.	Plow capacity.
.....	20-30	$2,300	4	Beav.....	4- 4¾ by 6	Ker.....	3-4
.....	1- 4	475	2	Own.....	1- 3½ by 5	G.....	1
.....	1½-3½	380	2	Own.....	1- 3½ by 4½	Gas.....	½
.....	12-24	1,750	4	Own.....	4- 4½ by 5½	G, K, D...	3
.....	9-18	1,385	4	Gray.....	4- 3½ by 5	Gas.....	2
.....	15-30	1,750	4	Wauk.....	4- 4¼ by 5¾	Gas.....	3
.....	10-20	1,295	.....	Wauk.....	4- 3¾ by 5½	G, K.....	2-3
.....	15-25	.....	4	Own.....	4- 4½ by 5½	G, K, D...	3
.....	12-25	.....	4	Own.....	2- 6½ by 7	G, K, D...	3
.....	28-53	5,250	*2	Wisc.....	4- 5¾ by 7	G, D.....	6
.....	12-22	.....	4	.....	4- 4 by 4	Ker.....	2-3
.....	16-30	.....	4	.....	4- 4½ by 6	Ker.....	3-4
.....	12-25	1,650	4	Wauk.....	4- 4 by 5¾	G, K.....	2-3
.....	9-18	1,175	4	Own.....	2- 5½ by 6½	Gas.....	2
.....	15-30	2,500	4	Baer.....	4- 4½ by 6	Ker.....	3-4
.....	16-30	.....	4	Clim.....	4- 5 by 6½	G, K, D...	4
.....	12-25	.....	4	.....	4- 4½ by 5½	Ker.....	3

Specifications of current models of passenger cars.[1]

[* 6-passenger; † 4-passenger; ‡ 3-passenger; ° Special Body. Engine make: Cont., Continental. D. Ly., Dort Lycoming. Dues., Duesenberg. GBS, Golden, Belknap & Swartz; H-S., Herschell-Spillman. Lyc., Lycoming. Nort., Northway. Rut., Rutenber. Tec., Teetor. Wal., Walther. Wisc., Wisconsin. Weid., Weidely. LeR., LeRoi. § Model 47, 34×4½ tires.]

Name and model.	Engine make.	Cylinders, bore and stroke.	WB.	Tires.	2-passenger.	5-passenger.	7-passenger.	Coupe.	Sedan.
Ace	H-S	6-3½ by 5	115	32 by 4	$2,260	$2,260			
Allen, Series 43	Own	4-3½ by 5	110	32 by 4		1,595			$2,395
American, C	H-S	6-3½ by 5	127	32 by 4	2,395	2,395	$2,475	$3,295	3,495
Anderson, 30	Cont	6-3½ by 4½	120	33 by 4	2,195	2,145	2,195	3,200	3,200
Apperson, 8-28-S	Own	8-3½ by 5	130	34 by 4½		† 3,500	3,500	4,500	4,500
Apperson, Anniversary	Own	8-3½ by 5	130	34 by 4½		4,250	4,250	6,000	6,000
Ardsley, 6-30 H-K	Cont	6-3½ by 4½	120	32 by 4	† 1,945	1,895		2,995	2,995
Begg, 24T	Cont	6-3½ by 4½	121	33 by 4		2,000			
Bell	H-S	4-3½ by 5	114	31 by 4	† 1,495	1,495			
Biddle, B1	Pida	4-3½ by 5½	121	32 by 4	3,750	† 3,750	3,950		
Boar, Axle, 21	Cont	6-3½ by 5½	126	33 by 4½	‡ 2,585	2,535	2,585		
Brearley, Four						1,265			
Brewster	Own	4-4 by 5½	125	34 by 4½		† 9,000			10,500
Briscoe, 4-31	Own	4-3½ by 5	109	31 by 4	1,285	1,285		1,885	1,885
Brook, S-21	Own	2-3½ by 3.67	90	28 by 3	395				
Buick, 21-44-S-47	Own	6-3½ by 4½	118	§ 33 by 4	1,795	1,795		2,585	2,895
Buick, 21-48-S-50	Own	6-3¾ by 4½	124	34 by 4½			2,065	2,985	3,295
Cadillac, 59	Own	8-3½ by 5½	125 132	34 by 4½ 35 by 5	3,790	†3,790	3,940 3,740	4,540	4,850 4 990
Case, V	Cont	6-3½ by 5½	126	34 by 4½		2,650	2,650	3,400	3,750
Chalmers, 6-30	Own	6-3½ by 4½	117	32 by 4	1,795	1,755		2,595	2 745
Chalmers, 6-36	Own	6-3½ by 4½	122	33 by 4½			1,945		
Champion, C1	H-S	4-3½ by 5	118	32 by 4	†1,595	1,595			
Chandler	Own	6-3½ by 5	123	33 by 4	†1,895	†1,975	1,895	2,895	2,995
Chevrolet, 490	Own	4-3 1/8 by 4	102	30 by 3½	795	820		1,325	1,375
Chevrolet, FB	Own	4-3 1/8 by 5½	110	33 by 4	320	1,345		2,075	2,075
Cleveland, 40	Own	6-3 by 4½	112	32 by 4	1,435	1,435		2,345	2,445
Climber Four	H-S	4-3½ by 5	117	33 by 4	1,550	1,550			
Climber Six	H-S	6-3½ by 5	125½	32 by 4½	2,750	2,750		3,250	
Cole, 870	Nort	8-3½ by 4½	127	33 by 5	3,250	†3,250	3,250	4,250	4,450
Columbia, D-C & CS	Cont	6-3½ by 4½	115	32 by 4	1,945	1,795		2,895	2,895
Comet, C-53	Cont	6-3½ by 5½	125	33 by 4½		2,350			
Commonwealth	H-S	4-3½ by 5	117	32 by 4		1,595			2,465
Crawford, 21-6-40	Cont	6-3½ by 5½	122½	32 by 4	3,000	3,000	3,000	4,500	4,500
Crow-Elkhart, 1-53-55	Lyc	4-3½ by 5	117	33 by 3½	1,295	1,295			2,105
Crow-Elkhart, 1-53-55	H-S	6-3½ by 5	117	33 by 4	1,545	1,545			2,305

Dixie Flyer, H–8–70	H–S	4–3½	by 5	112	32 by 4	1,595	1,595		2,570	2,570
Dodge Brothers	Own	4–3⅞	by 4½	114	32 by 3½	1,235	1,235		1,900	2,150
Dorris, 6–80	Own	6–4	by 5	132	33 by 5		[1]4,7 11	4,785	5,800	6,690
Dort, 15	D–Ly	4–3½	by 5	106½	30 by 3½	1,085	1,085		1,765	1,765
Dupont, A	Own	4–3½	by 5½	124	32 by 4½	3,400	†3,400			4,900
Elcar, D. H. K. G	Lyc	4–3½	by 5	117	33 by 4		1,495	†1,495	2,095	2,195
Elcar, D. H. K. G	Cont	6–3½	by 4½	117	33 by		1,795	†1,795	2,395	2,495
Elgin, K	Falls	6–3½	by 4½	118	33 by	†1,895	1,775		2,685	2,685
Essex, A	Own	4–3½	by 5	108½	32 by 4	1,595	1,595		2,100	2,450
Ferris	Cont	6–3½	by 5½	130	32 by 4½			*3,350		4,875
Ford, T	Own	4–3½	by	100	30 by 3½	395	440		745	795
Franklin, 9–B	Own	6–3½	by	115	32 by 4	2,400	2,600	†2,500		3,000
Grant, HX	Own	6–3⅞	by 4½	116	32 by 4	1,550	1,550		2,450	2,450
Gardner	Lyc	4–3½	by 5	112	32 by 3½	‡1,195	1,195			2,145
Halladay, M	Rut	6–3½	by 5	122						3,260
Hanson, 54	Cont	6–3½	by 4½	118	33 by 4		2,285			
Hatfield	H–S	4–3½	by 5	121	32 by 4	2,365	2,365	†2,465	2,885	2,885
Haynes, 47	Own	6–3½	by 5	115	32 by 4	1,695	1,695			
Haynes, 48	Own	12–2½	by 5	132	32 by 4½	†2,685	2,935	2,935	3,650	4,250
Huffman, R	Cont	6–3½	by 4½	120	34 by 4½		†3,635	3,635	4,350	4,950
H. C. S	Weid	4–3½	by 5½	120	32 by 4	1,995	1,995			2,975
Hollier, 206–B	Cont	6–3½	by 4½	120	32 by 4½	2,925	†2,975			
Holmes	Own	6–3½	by 4½	126	32 by 4	1,985	1,985			
Hudson, Super 6 O	Own	6–3½	by 5	126	34 by 4½	†3,350		3,350	4,250	4,550
Hupmobile	Own	4–3½	by 5½	112	34 by 4½	†2,400		2,400	3,275	3,400
Jackson, 638	Cont	6–3½	by 4½	121	32 by 4	1,685	1,685		2,725	2,800
Jones, 28	Cont	6–3½	by 5½	126	34 by 4½	†2,885	2,550			
Jordan, F	Cont	6–3½	by 5½	127	32 by 4½	2,750	2,750	2,750		
Jordan, M	Cont	6–3½	by 4½	120	32 by 4½			2,875		
Kenworthy, 6–55	Cont	6–3½	by 5½	130	32 by 4	2,650	2,650		3,700	3,700
Kenworthy, 4–80	Dues	4–4	by 6	130	32 by 4½	4,250	4,250	4,250		
King, H	Own	8–3	by 5	120	32 by 4½	5,000	5,000	5,000		
Kissel, 45	Own	6–3½	by 5½	124	32 by 4½	2,850	†2,835	2,835		4,235
Kline Kar, 6–55–K	Own	6–3½	by 5½	124	32 by 4½	3,475	†3,475	†3,475	4,275	4,275
LaFayette	Cont	6–3½	by 4½	121	33 by 4	2,290	2,290	†2,290	3,250	3,290
Leach, 21–A–B & C	Own	8–3½	by 5½	132	33 by 5		5,625	5,625	7,200	7,400
Lexington	Cont	6–3½	by 5½	127	32 by 4½	5,700	5,200	5,700		
Liberty, 10–C	Cont	6–3½	by 4½	122	32 by 4		†2,285			2,785
Lincoln	Own	6–3½	by 5	117	32 by 4	1,795	1,795	†1,885	2,825	2,850
Locomobile, 48	Own	8–3½	by 5½	130	33 by 5	4,600	4,600	4,600	5,750	6,000
Lone Star	Own	6–4½	by 5½	142	35 by 5		†7,650	7,550	10,600	11,300
Lorraine	Lyc	4–								
Madison	H–S	4–3½	by 5	114	32 by 4		1,575			
Malbohm, B	Own	6–3½	by 5	115	33 by 4	1,570	1,570			
Marmon, 34	Own	6–3½	by 4½	116	32 by 4	1,575	1,575		2,395	2,395
Maxwell, 25	Own	6–3½	by 5½	136	32 by 4½	5,300		5,000	6,150	6,600
McFarlan, 147	Own	4–3½	by 4½	109	30 by 3½	995	995		1,595	1,695
Mercer, Series 5	Own	6–4½	by 6	140	35 by 5	6,300	†6,300	6,300	7,500	7,500
Meteor, K & R	Own	4–3½	by 6½	132	32 by 4½	3,095	†3,950	*3,950	5,150	5,650
	Dues	4–4½	by 6	129	32 by 4½	5,500	5,500			

[1] Motor World, Dec. 4, 1920.

Specifications of current models of ***passenger cars*** –Continued.

Name and model.	Engine make.	Cylinders, bore and stroke.	WB.	Tires.	2-passenger.	5-passenger.	7-passenger.	Coupe.	Sedan
Metz, M6	Rut	6-3½ by 5	120	32 by 4	$1,995	$1,995	.....	$2,795	$2,895
Mitchell, F-40	Own	6-3½ by 5	120	33 by 4	1,750	1,750	.....	2,800	2,900
Monitor, S-3	Cont	6-3½ by 4½	121	33 by 4	2,475	2,475	.....	.....	3,475
Monroe, S-9	Own	4-3½ by 4½	115	32 by 3½	1,440	1,440	.....	.....	.....
Moon, 6-48	Cont	6-3½ by 4½	122	32 by 4	2,085	1,985	.....	2,985	2,985
Moon, 6-68	Cont	6-3½ by 5½	125	32 by 4½	2,585	.....	$2,495	3,485	3,485
Moore, 30	Own	4-3 by 5	106	30 by 3½	.....	1,095	.....	.....	.....
Murray	Own	8-3½ by 5	128	34 by 4½	.....	3,500	.....	.....	.....
Nash, 681-6	Own	6-3½ by 5	121	33 by 4	1,695	1,695	†1,850	.....	.....
Nash, 682	Own	6-3½ by 5	127	34 by 4½	.....	.....	1,875	2,650	2,895
National Sextet, BB	Own	6-3½ by 5½	130	32 by 4½	3,750	†3,750	3,750	4,900	4,950
Nelson, D	Own	4-3½ by 4½	101	32 by 4	.....	†1,700	.....	.....	.....
Noma, 10	Cont	6-3½ by 4½	128	32 by 4½	3,000	3,200	.....	.....	.....
Norwalk, 430 KS	Lyc	4-3½ by 5	116	32 by 3½	.....	1,345	.....	.....	.....
Oakland, 34-C	Own	6-2 13/16 by 4½	115	32 by 4	1,395	1,395	.....	2,065	2,065
Ogren, 6-60	Own	6-3½ by 5½	131	.....	.....	3,750	*3,900	4,750	5,200
Old-mobile, 46	Own	8-2½ by 4½	122	33 by 4½	.....	2,100	2,100	.....	3,300
Oldsmobile, 37-A	Own	6-2 13/16 by 4½	112	32 by 4	1,450	1,450	.....	2,115	2,145
Olympian	Own	4-3½ by 4½	112	32 by 3½	1,585	1,585	.....	2,485	2,585
Overland, 4	Own	4-3½ by 4	100	30 by 3½	895	895	.....	1,425	1,475
Owen Magnetic, 60	Own	6-4 by 5½	142	35 by 5	*7,000	7,000	7,000	8,000	8,500
Packard, Six	Own	6-3½ by 4½	116	33 by 4½	‡2,795	2,795	.....	4,150	4,250
Packard	Own	12-3 by 5	136	35 by 5	6,000	6,000	6,000	8,200	8,450
Paige, 6-42	Own	6-3½ by 5	119	32 by 4	1,770	*1,700	.....	2,895	2,945
Paige, 6-66	Cont	6-3½ by ...	131	33 by 4½	.....	.....	2,795	3,675	3,750
Pan, A	Own	4-3½ by ...	108	33 by 4	.....	1,500	.....	.....	.....
Pan American	H S	6-3½ by ...	121	33 by 4	2,450	2,450	.....	.....	3,000
Paterson, 65	Cont	6-3½ by 4½	120	33 by 4	.....	1,895	1,925	2,895	2,895
Peerless, 56	Own	8-3½ by 5	125	34 by 4½	.....	†3,200	3,230	3,920	4,140
Piedmont, 4-30	Lyc	4-3½ by ...	116	32 by 3½	.....	1,485	.....	.....	.....
Piedmont, 6-40	Cont	6-3½ by 4½	122	32 by 4	.....	945	.....	.....	.....
Pierce-Arrow, 48	Own	6-4½ by 5½	142	35 by 5	†7,900	7,900	8,000	9,000	.....
Pierce-Arrow, 38	Own	6-4 by 5½	134	34 by 4½	7,500	7,500	7,500	8,500	9,000
Pilot, 6-45	Tee	6-3½ by 5	120	32 by 4	1,048	1,895	.....	2,850	2,900
Porter, 45	Own	4-4½ by 6½	142	35 by 5	6,750	Chassis	price.	.....	.....
Premier, 6-D	Own	6-3½ by 5½	126½	32 by 4½	4,000	4,000	5,000	6,100	
Ranger, B	Own	4-3½ by 5	116	32 by 4	.....	1,850	.....	.....	.....
R. & V. Knight, R	Own	4-3½ by 5	116	32 by 4	.....	2,150	.....	.....	2,700
R. & V. Knight, J	Own								

Rock Falls	Own	6-3¼ by 5¼	*136*	*35 by 5*				4,500	5,000
Saxon, 125	Own	4-3⅜ by 5	*112*	*32 by 4*		1,895		2,705	2,795
Sayers, Six-42	Cont	6-3½ by 4½	118	33 by 4	2,595	2,195			3,295
Scripps-Booth, Six-B	Nort	6-2¾ by 4½	115	32 by 4	‡1,545	1,545		2,215	2,295
Seneca, L	LeR	4-3½ by 4½	108	30 by 3½	1,185	1,185			
Severin, Six	Cont	6-3½ by 5½	122	32 by 4		2,400			
Sheridan, 4	Nort	4-3⅛ by 5½	116	33 by 4					
Sheridan, 8	Nort	8-3¼ by 4½	132	33 by 5					
Singer, Series 20	Weid	6-2½ by 5	138	33 by 5	6,500	†6,500	6,500		8,600
Skeleton, 35	Lyc	4-3½ by 5	112	32 by 3½	1,245	1,245			
Standard, I	Own	8-3¼ by 5	127	34 by 4½					
Stanley Steamer	Own	2-4 by 5	130	34 by 4½		3,950	3,950	5,650	5,775
Stanwood Six	Cont	6-3½ by 4½	118	33 by 4		2,050			
Stearns, S K L4	Own	4-3⅝ by 5⅝	125	34 by 4½	2,550	2,450	2,675	3,400	3,700
Stephens, 80	Own	6-3½ by 4½	122	33 by 4½	2,400	†2,400	2,400	3,400	3,400
Stevens Duryea	Own	6-4 7/8 by 5½	138	35 by 5	†8,000		8,000	9,500	9,500
Studebaker, EJ-40	Own	6-3½ by 4½	112	32 by 4	¶1,850	1,485			2,450
Studebaker, EH-50	Own	6-3¼ by 5	119	32 by 4	†1,750	1,750	†1,750	2,650	2,750
Studebaker, EG-60	Own	6-3¼ by 5	126	33 by 4½			2,150		
Stutz, H	Own	4-3⅜ by 6	130	32 by 4½	3,500	†3,600	*3,600		
Templar, A-445	Own	4-3⅜ by 5½	118	32 by 4	2,885	†2,885		3,785	3,785
Texan, A-38	Lyc	4-3½ by 5	115	33 by 4	1,495	1,495			
Texan, C-12	H-S	4-3½ by 5	115	33 by 4	1,650	1,650			
Tulsa, E	H-S	4-3½ by 5	117½	33 by 4	1,550	1,550			
Velie, 48	Cont	6-3½ by 4½	115	32 by 4	1,885	1,885	†2,100	2,650	2,650
Velie, 34	Falls	6-3½ by 4½	112	32 by 3½		1,385			
Vogue, 655	H-S	6-3½ by 5	124	32 by 4		2,285			
Vogue, 656	Cont	6-3½ by 5½	124	33 by 4½		2,485			
Wasp, 2011	Wisc	4-4½ by 5½	132	33 by 5		†6,500			
Westcott, C-48	Cont	6-3½ by 5½	125	32 by 4½		2,990	2,990		4,590
Westcott, C-38	Cont	6-3½ by 4½	118	33 by 4	2,290	2,290			3,390
Willys-Knight, 20	Own	4-3½ by 4½	118	33 by 4	2,195	2,195		2,845	2,945
Winther, 61	H-S	6-3½ by 5	120	33 by 4					
Winton, 25	Own	6-3¾ by 5¼	132	35 by 5	4,600		4,600		6,200

RETAIL PRICES F. O. B. FACTORY, JUNE, 1919.

The following table [1] presents a general comparison between prices of American and European cars of similar general chara istics. Noteworthy is the low price and in many cases the gr capacity of the American cars represented in the group.

Make.	Number of cylinders.	Horse-power.	Capacity.	Where made.
High-priced cars (chassis only):			*Passengers.*	
Isotta-Fraschini	8			Italy
Rolls-Royce	6	45		England
DeLaunay-Belleville				France
Daimler	6	45		England
Pierce-Arrow	6	48		America
Do	6	38		do
Daimler	6	30		England
Lanchester	6	40		do
Packard	12	43		America
Medium high-priced, including touring car body:				
Sunbeam	6	24		England
Crossley	4	27		do
Wolsely	6	37		do
Do	6	27		do
Winton	6	48		America
Marmon	6	34		do
Cadillac	8	31		do
Haynes	12	36		do
Cole	8	39		do
Medium low-priced, including touring car body:				
Sunbeam	4	16		England
Talbot	4	12	4	do
Wolsely	4	18		do
Vulcan	8	23	5	do
Moon	6	29	7	America
Vulcan	4	17	5	England
Swift	4	12	4	do
Haynes	6	29	7	America
Enfield-Allday	6	15		England
Berliet	4	15	5	France
Hudson	6	30	7	America
Peugeot	4	12	5	France
Chandler	6	29	7	America
Buick	6	27	7	do
Chalmers	6	25	7	do
Studebaker	6	29	5	do
Buick	6	27	5	do
Low priced, including touring car body:				
Humber	4	14	4	England
Do	4	10	4	do
Fiat	4	11	5	Italy
Essex	4	18	5	America
Hupmobile	4	17		do
Citroen	4	10	4	France
Saxon	6	20	5	America
Dodge	4	24	5	do
Oakland	6	19	5	do
Chevrolet	4	22	5	do
Overland	4	18	5	do
Maxwell	4	21	5	do
Ford	4	16	5	do

[1] Data on American cars furnished by National Automobile Chamber of Commerce and retail that on foreign cars from report of Mr. C. C. Hanch, secretary of that body, in his report on "Aut Situation in European Countries" presented at the annual meeting June 6, 1919.

Materials entering into the manufacture of an "average" automobile.[1]

	Pounds.
iron for gray and malleable castings	630.0
bon steel sheets	500.0
bon steel in billets and bars	200.0
bon steel springs	113.0
y steel	100.0
per	36.0
le rubber	20.0
nganese	10.5
	7.5
	7.0
	5.0
timony	1.0
Total	1,630

NOTE.—About 10 per cent, or 30 pounds of the carbon steel bars and alloy steel are remelted as scrap.

tput per day during the month of October, 1919, of the 33 largest producers of motor cars.[2]

ord	3,100	Packard	42
evrolet	1,000	Paige	35
ick	500	Liberty	35
dge	400	Columbia	30
twell	375	Peerless	25
rland	300	Scripps-Booth	25
land	225	Grant	25
	175	Saxon	20
debaker	165	Jordan	18
	150	Bailey	12
dson	120	Winton	10
ex	120	King	10
llac	110	Olympian	10
ndler	110	Paterson	10
	100	Malbohm	8
mers	80		
pp	65	Total	7,470
coe	60		

FOREIGN TARIFFS.

Canadian.—Under the tariff of 1908 automobiles are dutiable at per cent ad valorem. In addition to this there was an additional ar tariff of 7½ per cent on American cars, amounting to only 5 per nt on British cars and those of certain other countries. The war riff has now been removed.

In addition to the tariff there was, in 1918, an inland-revenue x of 10 per cent laid on imported cars, to be assessed on the duty-id value of the cars. By a customs ruling, for the purpose of com-ting the regular and war tariffs, but not the inland-revenue tax, any ternal-revenue tax laid on articles by the United States Govern-ent must also be added to the dutiable value of the articles when ported into Canada. The sum of these Canadian imposts amounted the case of a car sold by the manufacturer for $1,000 to $588.75. ee below.)

British.—By British legislation for the reconstruction period, assenger automobiles were made dutiable at 33⅓ per cent. Com-ercial vehicles are admitted free. It is probable that the tariff on otor vehicles will be considered, and probably revised, in the early art of 1920.

Belgian.[3]—The present duty on automobiles is 80 francs per 100 lograms, or at the normal rate of exchange, about $7.12 per 100 ounds, for all machines weighing less than 4,400 pounds and includ-g passenger cars weighing up to 8,800 pounds. Commercial cars

[1] Information supplied by the National Automobile Chamber of Commerce to War Industries Board in 18. Reprinted in "Fact and Figures" of the National Auto. Chamber of Commerce, April, 1919. It is t stated how the average was arrived at. It is noted that glass, leather, and paint are not included.
[2] Motor Age, Nov. 6, 1919.
[3] Commerce Reports, Jan. 15, 1920. According to National Automobile Chamber of Commerce, the lgian duties have since been increased.

weighing between 4,400 and 8,800 pounds pay 60 francs per 100 kilograms, or $5.34 per 100 pounds, and all vehicles weighing over 8,800 pounds pay $2.67 per 100 pounds.

French.—The decrees of June 24, 1916, and March 30, 1918, in conformity to the law of May 6, 1916, raised to 70 per cent ad valorem the French tariff on automobiles weighing less than 5,500 pounds and on parts of same. The present paragraph covering this subject is No. 614 of the French Act. Designation, "Automobiles, chassis with or without motor, with or without body, weighing 1,100 to 5,500 pounds, and less than 1,100 pounds, 45 per cent ad valorem, for both general and minimum rates. Components, same rates."

Italy.—The following notice of automobile tariff changes in Italy has been reported to the Bureau of Foreign and Domestic Commerce by Trade Commissioner H. C. MacLean at Rome:

To equalize the present disparity between the low Italian duties on motor vehicles and the high duties which France, Great Britain, and the United States impose on these vehicles, the Italian Government has just decreed radical increases in the present rates.

Effective September 15, 1920, passenger automobiles (with or without bodies), trucks, traction engines, including farm tractors, motor-driven street-cleaning apparatus, and motor fire engines, will pay the following duty, in gold, per quintal:

	Lire.
Weighing not more than 400 kilos	30
Over 400 kilos up to and including 900 kilos	110
Over 900 kilos up to and including 1,600 kilos	60
Over 1,600 kilos up to and including 2,500 kilos	70
Over 2,500 kilos up to and including 4,000 kilos	90
Over 4,000 kilos	80

Automobiles, with or without bodies, weighing not more than 2,500 kilos will pay also a surtax of 35 per cent ad valorem.

Automobile bodies will be classified as automobiles. On automobile parts the following new duties, gold, per quintal will be established:

On frames, 70 lire; gear shifts, 110 lire; rear axles complete, 90 lire; all plus a surtax of 30 per cent ad valorem.

The restrictions on the importation of automobiles have been continued largely on account of the inadequacy of the old duties.—*Automobile Industries.*

Canadian impost on automobiles.

Selling price of car (United States tax of $50 paid by manufacturer)			$1,000
Regular Canadian tariff on selling price, 35 per cent	$350		
War Canadian tariff on selling price, 7½ per cent	[1] 75		
		$425.00	
Duty paid value, for computing Canadian inland-revenue tax		142.50	
			567.50
United States internal-revenue tax	50		
Regular and war Canadian tariff on United States internal-revenue tax, 42½ per cent			21.25
Total Canadian tariff and tax payable on importation			588.75

[1] Now (1920) revoked.

MOTOR CYCLES AND BICYCLES.

SUMMARY.

In 1914 capital to the amount of $18,134,950 was invested in the motor-cycle and bicycle industry, which is located chiefly in Massachusetts, New York, and the North Central States. The total value of products was $17,667,077, of which motor cycles represented about four-fifths. In 1919 production amounted to approximately $44,000,000, of which motor cycles represented three-fifths.

The United States and England are the largest producers, while Germany, France, and Belgium are also important manufacturing countries. In volume of production the United States and England do not greatly differ.

In general, the American and British types are distinct, the British machines being heavier, more elaborate, and higher in price. This distinction does not, however, apply with as great force to motor cycles as to bicycles. There is little demand in this country for the English type, which is sold at home at prices considerably above American prices for domestic machines. There is, however, some importation of parts, particularly chains.

The chief countries importing bicycles and motor cycles from the producers are the British Dominions, Russia, and the smaller European countries. Up to 1917 Great Britain led by a large margin in the bicycle export trade of the world. In that year her exports amounted to over $4,000,000, while those of her four principal competitors combined were a little over $2,000,000. In 1918, however, American exports of both motor cycles and bicycles were approximately equal to those of England. This was largely due to contraction of British trade during the war.

In view of the more efficient methods of manufacture in America and of the lower prices prevailing for types which satisfy the American demand, it does not appear that foreign competition or importation is likely to reach large proportions.

Motor cycles—Summary table.

Fiscal year.	Domestic production.	Imports for consumption.	Domestic exports.	Ratio to production.		Value (imports for consumption), including parts.	Amount of duty.	Value per unit of quantity.[3]	Equivalent ad valorem rate.
				Imports.	Exports.				
	Number.	*Number.*		*Per cent.*	*Per cent.*				*Per cent.*
1913			$749,072.00			$62,528.00	$28,137.60		45
1914	[1] 62,793		1,234,194.00	0.5	10.03	55,869.00	16,586.25		45, 25
1915			1,494,176.00			15,426.00	3,856.50		25
1916			3,369,815.00			36,104.00	9,026.00		25
1917			3,404,716.00			16,972.00	4,243.00		25
1918	53,700		2,364,785.00			3,860.00	965.00		25
1918[4]		2	2,169,385.00			454.00	113.50	$195.00	25
1919[4]	[5] 59,214	2	6,087,436.00	.002	41.5	2,016.00	504.00	65.00	25
1920[4]		47	10,756,580.00			15,472.00	3,868.00	170.00	25

[1] Value, $12,206,447.
[2] Year ending Aug. 31, data from War Industries Board.
[3] Based on complete machines, excluding parts.
[4] Calendar year.
[5] Value, $16,176,055.

Bicycles—Summary table.[1]

Fiscal year.	Domestic production.	Domestic exports.	Ratio to production.		Value (imports for consumption).	Amount of duty.	Equivalent ad valorem rate.
			Imports.	Exports.			
	Number.		*Per cent.*	*Per cent.*			*Per cent.*
1913	.....	$709,436.00	.....	.....	$121,375.00	$54,618.75	
1914	[2]398,899	608,031.00	3.82	11.34	205,062.00	54,958.30	6.8
1915	.....	424,892.00	.....	.....	66,252.00	16,562.80	
1916	[3]526,076	863,162.00	.....	.....	14,796.00	3,699.00	
1917	[3]606,918	1,320,363.00	.....	.....	36,901.00	9,225.25	
1918	[4]507,207	1,366,747.00	.....	.....	12,593.00	3,148.25	
1918[5]	.....	1,540,920.00	.....	.....	3,920.00	980.00	
1919[6]	470,675	3,234,915.00	.089	21.3	10,953.00	2,738.26	
1920[6]	.....	4,725,643.00	.....	.....	48,193.00	12,048.25	

[1] Value per unit of quantity, not shown.
[2] Value, $5,361,230.
[3] Year ending Aug. 31, data from War Industries Board.
[4] Estimate for year ending Aug. 31, based on 11 months' production.
[5] Calendar year.
[6] Value, $12,277,341.

General Information.

Paragraph 120, law of 1913.—Bicycles, motor cycles, and finished parts thereof, not including tires, 25 per cent ad valorem.

DESCRIPTION.

Both machines are made use of to a considerable extent by workmen and others as an everyday means of transportation to and from work. Both are used commercially for the delivery of messages and small parcels of merchandise, and by police organizations for patrol and special duty. Motor cycles are of great value for military as well as police purposes. As a pleasure vehicle, the bicycle has been almost completely displaced among adults in this country by the motor cycle and more especially by the automobile, but in Europe and other countries it has been retained in use to a much greater extent, both for pleasure and utility. Recently the introduction of the side car and the increased power and reliability of the motor cycle have contributed greatly to its popularity. Several light and cheap variations of the motor cycle have been put on the market, the small engine and the single-wheeled motor cycle designed for attachment to a bicycle, and the motor scooter. These devices have not made a great headway, and it seems unlikely, in view of their limited power, that they will come into very extended use. On the other hand, motor cycles have been developed to a point at which they are not greatly different from automobiles. Four-cylinder machines of 20 horsepower are made and side cars are provided with a seating capacity of two or more, and are equipped with tops, wind shields, and upholstery. A 3-wheeled cycle or car has come into considerable use in Europe, but in America this and other expensive forms meet with competition from the small low-priced 4-wheeled automobile, which is produced in very great quantities at prices even lower than those at which these highly developed motor cycles can be sold. The 3-wheeled car is also less satisfactory than the 4-wheeled on rough roads.

DOMESTIC PRODUCTION.

There was in 1914 capital to the amount of $18,134,950 invested the manufacture of bicycles and motor cycles and parts, and the lue of product was $17,667,077, of which amount motor cycles presented four-fifths; in 1919 the output had increased to $44,-0,066, of which motor cycles and parts accounted for but 60 per nt. The value of product in 1914 exceeded that of 1909 by over per cent, due to the growth of the motor-cycle business, but s much less than that of 1899, when the bicycle was near the ght of its popularity.

n the period from 1914 to 1919 the bicycle industry again showed id growth, much more so than the motor-cycle branch.

Materials.—The chief component materials are steel, in the form tubes, bars, and sheets, rubber fabric, and wood. Other com-nents are steel balls and leather, and for motor cycles, iron cast-s for cylinders and pistons, alloy steel, springs, and a small amount brass, copper, and aluminum.

Electric equipment is essential for ignition, and is also generally d for lighting. Practically all of the raw materials except the ber are obtained from domestic sources.

Bicycle chains are imported to some extent from England. (See ited States Tariff Commission survey on chains.)

Equipment.—Forge shops, foundries, and machine tools, includ-many special automatic machines for turning out certain parts, used in the manufacture of bicycles and motor cycles. So far is known all of the equipment used in the United States is of nerican make.

Methods of production.—For the production of first-class bicycles motor cycles considerable accuracy is required. Bicycle manu-ture is comparatively simple, and is carried on to a greater extent an is that of motor cycles in countries where manufacturing has t developed to a high degree, as Denmark, Norway, etc. The nufacture of motor cycles in quantity is confined chiefly to Ger-ny, England, Belgium, France, and to the United States. A nsiderable portion of the component parts are manufactured by ecialty concerns.

Organization.—The invested capital in 1914 was $18,134,950. ere were 78 firms engaged in the business, of which 6, producing the amount of $1,000,000 a year or more each, represented 69 r cent of the country's output, and 32, including the 6 before ntioned, producing over $100,000 each, represented 95 per cent the total. In the period of great popularity of the bicycle there s a strong movement toward consolidation, the American Bicycle being the most notable example. This concern absorbed a ge number of plants and operated them as a unit, devoting cer-n factories to the production of certain parts, and others to assem-ng. During this period, ending about 1897, there was a great ansion of the business, which then seemed to promise large fits, but with the sudden ending of the bicycling "fad" many these concerns failed, while a number of the larger ones took up manufacture of automobiles or motor cycles.

The Westfield Manufacturing Co. is now one of the largest Ameri-makers of bicycles, being the successor of the Pope Manufactur-Co. and controlling several valuable brand names, "Columbia,"

"Pope," "Crescent," "Stearns," "Rambler," "Spaulding," others.

The motor-cycle industry has increased rapidly, the greater of the business being divided between five or six competitive ma and it now exceeds the bicycle trade in point of value, althoug latter has now developed a new period of rapid growth.

The bicycle business following the sudden decline previous to remained nearly stationary till 1914, but since that year it has sh a considerable growth, due in part to export trade which partly planted that of Europe.

Side cars are made almost exclusively by specialists, and sold u the cycle manufacturer's name.

Geographical distribution.—The bulk of the industry is locate the States of Wisconsin, Illinois, Ohio, Indiana, Massachusetts, New York.

History.—The development of the bicycle has been marke intermittent waves of popularity. In its original form, the wheeled frame pushed by the action of the feet on the groun became somewhat of a fad for a short time in 1819, and again in 1 when cranks were attached to the front wheels. After that date bicycle was developed in England, where the earlier forms origina and its use slowly increased until soon after 1890, when it reac substantially its present form, and its use for pleasure and spor purposes suddenly developed into a "craze," which in a few year suddenly declined. There has remained a steady demand for bicycle as a utility, widely used as a means of cheap transporta by laboring people and by boys. The use of the motor cycle bot a utility and as a pleasure vehicle, has increased rapidly since 1 due to improvements in design which rendered it reliable and plea able to operate, and to the introduction of the side car, permit the carrying of one or more passengers. Important military were found for the motor cycle during the war, the United St Government taking about one-half of the 1918 production.

Domestic production and consumption.—In the early days of bicycle industry, England, where it was first developed, produ nearly all the bicycles for the world, but when the period of po larity arrived, manufacture was quickly pushed in the United Sta which has since produced nearly all her own consumption, and built up a large export trade. In the year 1919, 42 per cent of domestic production of motor cycles was exported, and about 21 cent of the bicycle production.

Domestic exports.—The principal foreign trade of the United Sta in bicycles has been with Canada, Central and South America, recently a large proportion of the exports has gone to Cuba, Jap and Italy. The principal motor cycle export trade which has dev oped since the European war began with Australasia, Italy, a South Africa, supplanting in large part the trade of England a Germany, together with an increasing trade with Canada and t Central and South American countries. The principal foreign m kets of the world for motor cycles are South Africa, the Uni Kingdom, Australia, New Zealand, India, Russia (prewar) a Italy. For bicycles the same countries, with France, Holland, Jam and Scandinavia are the chief consumers (see page 53). Before t war, England commanded both the bicycle and motor cycle trade all these countries with the exception of the motor-cycle busines

nce and Italy, which she divided with Germany, and both the cle and motor cycle trade of Russia, which was chiefly German. many also controlled the bicycle trade of Holland and Scandia. In 1918, as a result of the war, the United States obtained a re of the motor cycle export trade as large as that of England. Miscellaneous.) Great Britain, however, retained her control he bicycle trade. The United States obtained a large share of bicycle export business during the war only in Japan, Canada, Australia. Preference for English designs is probably the chief or rather than price.

FOREIGN PRODUCTION.

The principal countries producing motor cycles and bicycles are gland, Germany, and the United States. France, Belgium, land, Japan, and the Scandinavian countries also manufacture to onsiderable extent. No recent production figures are available, the importance of the producing countries is indicated by an mination of their export trade. (See Miscellaneous.)

Bicycles.—In 1913 the exports of England amounted to $8,154,546, se of Germany to $5,662,782, and those of France to $1,309,466. e total production of the United States in 1914 was $3,757,318. 1917 twice as many bicycles were made in America as in 1914, ile exports of England and France each fell to one-half of the 1914 ures. The use of the bicycle is much more general in Europe and ne other parts of the world than in this country. In many coun- s a larger portion of the roads is adapted to bicycling, and the bits and resources of a large part of the people favor the use of the cycle rather than the automobile. In much of Europe and parts Asia the bicycle is used almost universally, both for transportation d pleasure. The British bicycle is usually a higher developed maine than the American; it often has a two or three speed transmisn, two hand brakes, chains and gears protected by guards, and is the highest quality of workmanship. The purchasers, many of om are of the class which in this country would own a motor cle or motor car, are not so greatly concerned about the price. ese machines, of considerably higher price, do not find a market re, where such refinements would be looked upon rather unfavorably the class which uses bicycles. The Japanese machines, on the er hand, are of cheap construction. Canada produced bicycles in 16 to the value of $147,266.

Motor cycles.—The United States, England, Germany, and Belgium the principal motor-cycle producers. There is also some produc- n in France and Switzerland. British production in 1913 is said have been 60,000 [1] motor cycles; that of the United States was 154 in the same year. In 1919 American production was 59,214.[2] was estimated in November, 1919, that British production in 0 would amount to 80,000.[1] The British motor cycle, like the ycle, is usually more elaborate, heavier, and more expensive n the American and is not in demand here. English motor les have been greatly improved in quality as a result of the war erience of the manufacturers, and reductions in cost have been cted through greater standardization.

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[1] Maj. Watkins, manager motor-cycle show, November, 1919, London.
[2] U. S. Census of Manufactures, 1919, preliminary report.

There are three English firms which are fairly well integrated and have a capacity of over 10,000 motor cycles per year. Most of the smaller firms purchase their parts for assembly. All of the tubing, balls, and chains and many of the engines, gear boxes, forks, etc., are made by special concerns. English manufacturers before the war obtained their spokes and balls from foreign sources, but these are now supplied by home producers.[1] Glass for lamp lenses, which had been imported from Germany, is now obtained from British and American sources.[1] Other parts are mostly made and assembled in one plant, but the tubing is purchased from tube mills. Holland and the Scandinavian countries also produce bicycles in considerable quantity. Holland has 23 factories, but does not supply all of her own demand or export to any extent.[2]

IMPORTS.

Imports were increasing up to the time of the European war and were chiefly from England, with a portion from Germany. At the maximum in 1914, under a duty of 25 per cent ad valorem, importation of bicycles amounted to $205,062, which was not above 6 per cent of the American production, and in 1919 was less than $7,000. Imports were almost negligible in the case of motor cycles. There is some importation of English parts, particularly chains, for assembly in American bicycles.

PRICES.

The price of bicycles has decreased greatly since the early days of the industry. In 1894,[3] when the period of great popularity began, the retail price of a good bicycle averaged in the neighborhood of $150.[3] Within a year the price had been reduced to about $100, and by 1900, when the "craze" had subsided, to about $50. Five years later the price ranged between $35 and $50, and at the present time (1920) is in the neighborhood of $50 for a good bicycle.

The retail price in England of a so-called touring model, fitted with three-speed gear, hand brakes, chain case, and other accessories, is from $95 to $120. A high-grade model corresponding more nearly to the type usual in the United States with the single-speed coaster brake, retails for about $70.[4] The cheapest English model now made retails at $39,[4] which is somewhat higher than that of the cheapest American model. English prices advanced between 80 and 100 per cent during the war.

The price of a high-grade bicycle in Belgium is stated [5] to have increased from about $50 in prewar times to $85 or $90 in February, 1920.

Motor-cycle prices are not strictly comparable from year to year, as changes in design often radically affect the price. A comparison between American and British machines indicates that, as is the case of automobiles, American machines are of considerably greater power, and at the same time sell at lower prices. (See Prices, p. 52.) Examples are the two-cylinder "BSA" British machine of 6½ horsepower, with side car and electric equipment, which retails for $950, and which may be compared with two American makes having four

[1] Supplement to Commerce Reports 191I, 1919.
[2] Commerce Report, June 4, 1919.
[3] U. S. Census Report.
[4] English catalogues, and report of P. M. Tyler, Tariff Commission.
[5] Standard Daily Trade Service, Feb. 11, 1920.

cylinders and 20 horsepower which retail for about $640. The three-wheeled cycle cars made quite largely in England range in price from about $700 to $1,200 or more, and would offer little competition to the American automobile.

Motor cycles, bicycles and parts—Production in United States.

[From Federal Census.]

State.	1899	1904	1909	1914
Massachusetts	$2,715,310	$582,047	$2,706,258	$7,021,312
Illinois	8,960,421	1,161,481	1,777,464	4,064,739
Ohio	4,099,980	1,040,982	2,308,316	2,931,383
New York	3,842,020	758,789	1,165,271	1,649,744
Connecticut	3,672,225	.....	.....	.....
Wisconsin	2,795,236	44,456	.....	.....
All other	5,830,716	1,565,485	2,741,258	6,567,084
Total	31,915,908	5,153,240	10,698,567	22,234,262

The above figures include parts, which are used chiefly for assembly into complete machines, and do not include machines made by concerns not primarily cycle makers.

Motor cycles, bicycles [1]—Production in United States.

[From Federal Census, 1914, p. 753.]

	1899		1904		1909	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Motor cycles	160	$33,674	2,328	$359,180	18,628	$3,015,988
Bicycles	1,182,691	23,656,487	250,487	3,740,923	233,707	3,22[illegible],189

	1914		1919 [2]	
	Quantity.	Value.	Quantity.	Value.
Motor cycles	62,793	$12,306,447	59,214	$16,176,055
Bicycles	398,899	5,361,230	470,675	12,277,341

[1] Parts are excluded from the above figures, since they are used chiefly for assembly into complete machines.
[2] U. S. Census of Manufactures, 1919, preliminary report.

Bicycles, motor cycles—Production in United States.

From data presented to the priority committee of the War Industries Board by the War Service Committee of the Bicycle and Allied Industries Association.]

Bicycles:	
1916 [1]	526,076
1917 [1]	606,918
1918 [1]	[2] 507,207
Motor cycles: 1918 [1]	53,700

Motor cycles and bicycles—Production in principal foreign countries. [a]

Country.	1913	1914	1918	1920
Motor cycles.				
United States	.....	[b] 62,154	53,700	.....
England	[c] 60,000	.....	[d] 40,000	[e] 80,000

[a] American production shown for comparison.
[b] U. S. Census; value, $12,161,775.
[c] P. M. Tyler Tariff Commission, from Maj. Watkins, manager motor cycle show, 1919, London (February, 1920).
[d] Editor of Motorcycling, London (P. M. Tyler).
[e] Estimated.
[1] Twelve months, ending Aug. 31.
[2] Estimate based on 11 months' production.

Bicycles.

Country.	1913	1914	1916	1917	1918
United States		[2] 299,029	[3] [4] 526,076	[3] [4] 606,918	[3] [4] [5]
England	[2] 500,000				
Canada [7]					

[2] Value, $3,757,318.
[3] Estimate, supplement 19-H to Commerce Reports, 1919.
[4] Twelve months ending Aug. 31.
[5] Data from War Industries Board.
[6] Estimate based on 11 months.
[7] Canadian Census of Production, 1916, $147,284.

Motor cycles and bicycles, and parts of—Imports by countries (fiscal years).[1]

Imported from—	1912	1913	1914	1915	1916	1917	1918
United Kingdom	$112,627	$160,658	$197,153	$64,585	$37,943	$31,554	$5,[illegible]
Germany	26,493	21,915	47,876	11,212	579		
Belgium	2,684	653	5,639	210	94		
France	1,168	2,194	2,012	583	5,153	11,415	4,[illegible]
Canada	496	724	1,720	3,167	6,762	2,312	1,[illegible]
Japan		594	15	142		8,102	10,[illegible]
All other	868	242	1,886	1,243	409	420	[illegible]
Total	144,336	186,980	256,281	81,142	50,940	54,803	21,[illegible]

[1] In 1910 and 1911 included in "All other manufactures of iron and steel," and included in "Other cars, carriages, etc.," after 1918.

Bicycles and finished parts thereof, not including tires—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
1907 [1]	45 per cent		$30,403.00	$13,681.35		45
1908 [1]	do		52,214.00	23,496.30		45
1909 [1]	do		59,478.00	26,765.10		45
1910 [1]	do		103,664.14	46,648.86		45
1911 [1]	do		115,877.00	52,144.65		45
1912 [1]	do		144,183.97	64,882.79		45
1913	do		121,375.00	54,618.75		45
1914	do		18,439.00	8,297.55		45
1914	25 per cent		186,623.00	46,655.75		25
1915	do		66,252.00	16,562.50		25
1916	do		14,796.00	3,699.00		25
1917	do		36,901.00	9,225.25		25
1918	do		12,593.00	3,148.25		25
1919 [2]	do		3,920.00	980.00		25
1919 [2]	do		10,953.00	2,738.25		25
1920 [2]	do		48,193.00	12,048.25		25

[1] Includes motor cycles also.
[2] Calendar year.

'cles and finished parts thereof, not including tires—Imports for consumption—Revenue.[1]

'ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
						Per cent.
.....	45 per cent	.....	$62,528.00	$28,137.60	.....	45
.....	.....do	.....	12,095.00	5,442.75	.....	45
.....	25 per cent	.....	43,774.00	10,943.50	.....	25
.....	.....do	.....	15,426.00	3,856.50	.....	25
.....	.....do	.....	36,104.00	9,026.00	.....	25
.....	.....do	.....	16,972.00	4,243.00	.....	25
.....	.....do	.....	3,860.00	965.00	.....	25
.....	.....do	2	454.00	113.50	[2]$195	25
.....	.....do	2	2,016.00	504.00	65	25
.....	.....do	47	15,472.00	3,868.00	170	25

ycle imports were included with those of bicycles before 1913.
ır year.
n complete machines, excluding parts.

cycles, bicycles, and other cycles, and parts of—Domestic exports (fiscal years).

:ported to—	1910	1911	1912	1913	1914	1915
.....	$21,963	$21,773	$7,207	$28,892	$78,758	$27,599
ïew Zealand.....	54,337	50,549	55,557	54,347	172,991	230,409
ıth Africa.....	238	1,797	3,091	8,780	39,964	103,498
ewfoundland, and	79,159	156,686	275,675	394,064	260,008	190,257
ntral, South Amer-	106,155	137,315	141,728	176,933	130,126	78,434
.....	20,511	19,848	38,538	52,136	19,175	7,214
.....	26,948	30,355	42,289	56,292	73,453	66,477
ıgdom.....	125,922	169,620	165,751	278,050	425,851	670,416
.....	45,914	65,859	121,070	99,480	126,617	112,690
.....	139,513	229,398	275,807	309,534	515,282	432,074
.....	620,760	883,300	1,126,723	1,458,508	1,842,225	1,919,068

d to—	1916	1917	1918	Exported to—	1916	1917	1918
.....	$169,187	$413,818	$657,119	Japan.....	$44,233	$89,605	$276,627
ïew Zea-	810,474	930,647	609,351	Cuba.....	73,672	103,330	270,917
th Africa	233,273	275,545	466,316	United Kingdom...	940,395	169,324	63,282
ıth, Cen-	236,029	499,957	440,929	Denmark.....	263,998	248,575	15,933
rica.....	132,738	298,883	339,050	All other.....	1,328,779	1,695,395	592,003
				Total.....	4,232,778	4,725,079	3,731,532

Motor cycles—Domestic exports.

FISCAL YEAR.

ported to—	1913		1914		1915	
	Number.	Value.	Number.	Value.	Number.	Value.
ïew Zealand.....	160	$27,370	815	$139,027	1,042	$186,341
.....	115	23,208	342	70,054	121	24,190
th Africa.....	40	6,784	187	33,659	555	101,210
wfoundland, Lab-	1,338	237,079	1,073	195,985	839	141,241
ıtral, South Amer-	385	76,491	331	69,288	217	43,774
.....	40	9,220	76	16,443	122	21,472
.....	137	25,833	21	4,548	14	3,597
gdom.....	1,040	204,502	1,630	323,293	3,357	587,229
.....	85	17,819	409	75,620	649	137,771
.....	643	120,616	1,536	306,277	1,250	247,351
.....	3,983	749,072	6,410	1,234,194	8,166	1,494,176

Motor cycles—Domestic exports—Continued.

FISCAL YEAR—Continued.

Exported to—	1916		1917		1918	
	Number.	Value.	Number.	Value.	Number.	Value.
Australia, New Zealand	3,970	$757,206	4,106	$870,443	2,409	$538,288
Italy	790	147,223	1,666	349,667	1,940	464,681
British South Africa	1,144	204,302	1,364	252,478	1,574	449,966
Canada	989	150,914	1,069	197,707	1,044	199,488
Mexico, Central, South America	411	74,747	661	139,081	704	155,686
Spain	206	36,040	703	146,398	426	90,103
Japan	19	3,191	122	25,716	384	75,326
United Kingdom	3,956	765,220	287	61,710	28	5,700
Russia	2,121	498,076	35	7,050	.....	.....
All other	3,945	732,697	6,596	1,354,457	1,790	393,574
Total	17,500	3,369,616	16,609	3,404,716	10,599	2,364,715

CALENDAR YEARS.

Exported to—	1918		1919		1920	
	Number.	Value.	Number.	Value.	Number.	Value.
Belgium	.....	.....	571	$143,231	1,033	$323,204
Denmark	13	$4,500	1,281	348,265	741	208,685
France	71	16,534	272	84,421	672	184,400
Italy	1,538	372,522	1,069	296,584	2,281	652,450
Netherlands	.....	.....	2,656	716,681	5,181	1,423,854
Norway	80	19,870	1,787	518,472	1,788	517,422
Spain	367	88,098	1,079	283,232	1,416	457,946
Sweden	.....	.....	2,651	776,120	5,888	1,671,705
England	24	1,154	1,158	326,307	2,783	766,449
Canada	907	184,490	1,654	380,325	1,313	339,250
Cuba	153	35,772	175	46,330	221	60,014
Argentina	207	53,652	437	125,929	597	171,613
Brazil	54	14,611	247	82,835	268	81,695
China	99	18,619	239	47,883	157	49,574
British India	3	847	682	189,108	1,331	381,615
Dutch East Indies	274	53,526	634	142,007	1,283	371,762
Japan	509	114,582	864	208,066	751	205,806
British South Africa	1,258	323,083	1,786	480,814	1,536	450,225
Australia	1,898	458,487	2,004	570,967	2,910	855,581
New Zealand	672	163,529	1,308	378,020	2,007	560,741
All other	1,185	245,509	1,927	531,839	3,505	1,002,291
Total	9,212	2,169,385	24,481	6,687,436	37,662	10,756,590

Bicycles, tricycles, etc.—Domestic exports.

FISCAL YEARS.

Exported to—	1913	1914	1915	1916	1917	1918
Canada, Newfoundland, and Labrador	$156,985	$64,023	$49,016	$85,115	$302,250	$241,441
Cuba	48,007	57,473	52,597	61,455	88,254	234,360
Japan	26,343	14,627	3,617	41,042	63,889	196,308
Italy	5,594	8,704	3,409	21,964	64,151	192,458
Mexico, Central and South America	100,442	60,838	34,660	57,991	159,802	194,040
Australia, New Zealand	26,977	33,964	44,068	53,268	60,204	71,178
United Kingdom	73,188	102,558	83,187	175,175	107,614	37,570
British South Africa	1,966	6,305	2,288	28,971	23,067	16,470
Denmark	93,211	83,292	88,527	135,812	112,788	15,270
All other	176,433	176,247	63,523	202,369	338,344	155,525
Total	709,436	608,031	424,892	863,162	1,320,363	1,366,747

Bicycles, tricycles, etc.—Domestic exports—Continued.

CALENDAR YEARS.

to—	1918	1919	1920	Exported to—	1918	1919	1920
.....	$132,277	$378,060	$294,475	China.....	$8,406	$21,340	$55,365
.....	135,424	56,019	174,501	British India.....	11,117	25,529	81,117
.....	.....	151,887	297,828	Japan.....	406,495	522,444	1,369,899
.....	147,669	146,917	104,869	Australia.....	83,864	87,869	95,580
.....	515	141,726	331,459	New Zealand.....	12,090	32,940	76,603
.....	34,788	750,518	311,972	Philippine Islands..	62,776	119,183	102,326
.....	147,196	96,646	117,965	British South Africa.	13,569	44,478	77,459
.....	64,200	69,494	66,464	All other.....	171,564	383,258	733,344
.....	74,147	107,254	231,697				
.....	21,162	53,274	75,703	Total.....	1,540,920	3,234,915	4,725,643
.....	13,661	46,077	67,017				

· cycles and side car with electric equipment; prices, retail, February, 1920.

Kind or grade.	Cylinders.	Horsepower.	Cylinder capacity.	Where made.	Price.
			Cu. in.		
.....	2	6½	47	England....	$952.00
.....	2	.....	.....	.....do.....	854.00
.....	1	4½	34	.....do.....	742.00
.....	4	20	75	America.....	645.00
.....	4	.....	.....	.....do.....	645.00
.....	2	.....	73	.....do.....	570.00
.....	2	16	72	.....do.....	550.00
.....	2	16	61	.....do.....	545.00
dson.....	2	16	60	.....do.....	552.00
Solo motor cycle.					
.....	2	6½	47	England....	758.00
.....	1	4½	34	.....do.....	577.00
.....	4	20	75	America.....	560.00
.....	4	.....	.....	.....do.....	520.00
.....	2	.....	73	.....do.....	450.00
.....	2	16	72	.....do.....	430.00
dson.....	2	16	60	.....do.....	425.00
.....	1	.....	17	England....	315.00
.....	1	2½	.....	America.....	250.00

Motor cycles, bicycles, and parts—Rates of duty.

·.	Tariff classification or description.	Rates of duty, specific and ad valorem.
	Prior to the act of 1909 motor cycles and bicycles were dutiable according to the component material of chief value.	
1	* * * bicycles and motor cycles, and finished parts of any of the foregoing, not including tires.	45 per cent ad valorem.
0	Bicycles, motor cycles, and finished parts thereof, not including tires.	25 per cent ad valorem.

Court and Treasury Decisions.

ɜ and saddles, but not lamps, pumps, push bells, tool bags. and horns have been held to come within paragraph 120 as parts of bicycles. (G. A. 7700, T. D. 35223, and Abst. ıd 38014 of 1915.)

MISCELLANEOUS.

Exports of principal producing countries.[1]

Country.	Value of export.	Principal countries to which exported, importance.
Motor cycles and parts:		
1913.		
United Kingdom	$4,626,090	British possessions, Italy.
United States	749,072	Canada, United Kingdom.
Germany	634,032	Russia, Denmark.
Belgium	471,222	United Kingdom, Holland, Germany, F Italy.
France	182,366	French Africa.
Switzerland	128,800	France, Russia, Austria.
1917.		
United Kingdom	5,364,124	British possessions.
United States	3,404,716	British possessions, Italy.
Switzerland	54,338	France, Italy.
France	42,704	French Africa.
1918.		
United Kingdom	2,523,516	
United States	2,364,785	
Bicycles and parts:		
1913.		
United Kingdom	8,154,546	Holland, British possessions, Japan, Bel Italy.
Germany	5,662,782	Holland, Denmark, Belgium, Italy, United
France	1,309,466	Belgium, Italy, Germany, French Africa.
United States	709,436	Canada, Latin America, Denmark.
Italy	158,805	South America.
Canada	48,892	Australia.
1917.		
United Kingdom	4,042,056	British possessions, Italy, Holland, and Jap
United States	1,320,363	Canada, Latin America, Denmark.
France	688,477	Italy, French possessions, Spain.
Canada	76,857	Australia and New Zealand.
Italy	46,115	France, South America.
1918.		
United Kingdom	2,560,068	
United States	2,434,314	

[1] Report of Bureau of Foreign and Domestic Commerce.

Imports of principal consuming countries.[1]

Country.	1913	1917	Country.	1913
Motor cycles:			Bicycles—Continued.	
Russia	$301,852	$935,799	Russia	$1,308,573
Australia	651,909	825,752	Straits Settlements	259,281
British South Africa	1,087,780	604,102	Holland	733,864
British India		384,093	Sweden	155,163
New Zealand	397,388	341,219	Japan	1,052,873
Bicycles:			British South Africa	1,115,365
Australia	826,521	781,820	Spain	464,167
British India	1,149,466	602,915	United Kingdom	1,081,035

[1] Report of Bureau of Foreign and Domestic Commerce.

IRON AND STEEL AXLES.

[Par. 121-142, Act of 1913, 10 and 20 per cent.]

SUMMARY.

TARIFF PROVISION.

Paragraph 121 of the act of 1913 provides a 10 per cent ad valorem duty upon iron and steel axles. Axles inserted in wheels are provided for under paragraph 142, which levies a duty of 20 per cent ad valorem on wheels for railway purposes, and includes under the same rate axles inserted in such wheels. The axles included under paragraph 121 are not confined to those for railway purposes, as are the wheels falling under paragraph 142.

PRODUCTION AND IMPORTS.

In 1914, 89,436 long tons of axles were produced in the steel works and rolling mills of the United States, a product valued at $3,831,344. This figure includes 1,160 tons of axles other than railroad, valued at $96,069. Imports were 136 tons, valued at $17,083, only 0.15 per cent of the production as given above. Statistics of export of axles alone are not available.

The steel works and rolling mills producing iron and steel axles are located in Pennsylvania, New York, Ohio, and Indiana.

SIGNIFICANCE OF THE IMPORT AND DUTY.

Imports of iron and steel axles have not been sporadic, although they have been small and decreased steadily since 1911, especially after the outbreak of the war, up to 1919 and 1920, when there were small additional importations. They form but a negligible proportion of the total consumption.

Revenue under the act of 1909 averaged $9,500 yearly, collected at specific rates equivalent to 15 per cent ad valorem. The decreased imports under the 10 per cent rate of the act of 1913 have resulted in a negligible amount of revenue—less than $1,000 in 1917, and disappearing entirely in the next year, when there were no imports.

Iron and steel axles—Summary table.

Year.	Domestic production.[1] [2]	Imports for consumption.[2]	Domestic exports.	Imports, ratio to production.
	Long tons.	*Long tons.*		*Per cent.*
1909	102,348	[4] 332		0.324
1910		[4] 856		
1911		[4] 1,014		
1912		[4] 244		
1913		[4] 210		
1914	89,436	[4] 136		.152
1915		50		
1916		75		
1917		68		
1918		None.	[5] $5,220,704	
1919[3]		4	[5] 6,889,044	
1919[3]		23	[5] 11,843,738	
1920[3]		141	[5] 9,061,305	

Notes on p. 58.

Iron and steel axles—Summary table—Continued.

Year.	Value (imports for consumption).[2]	Amount of duty.[2]	Value per unit of quantity.	Equivalent ad valorem rate.
			Per pound.	*Per cent.*
1910	[4] $94,953.00	$14,530.42	$0.060	15.3
1911	[4] 114,987.00	17,030.75	.054	14.8
1912	[4] 27,503.00	4,097.64	.05	14.9
1913	[4] 24,445.00	3,320.68	.052	14.6
1914	[4] 17,083.00	2,046.33	.050	11.9
1915	5,944.00	594.40	.022	10.0
1916	10,455.00	1,045.50	.062	10.0
1917	9,872.00	987.20	.065	10.0
1918	None.	None.		
1918[3]	50.00	5.00	.004	10.0
1919[3]	2,113.00	211.30	.038	10.0
1920[3]	107,119.00	10,711.90	.034	10.0

[1] Rolled or forged, made in steel works and rolling mills.
[2] Calendar year.
[3] Fiscal year.
[4] Only those valued at 6 cents per pound or less, till Oct. 4, 1914.
[5] Car wheels and axles.

General Information.

DESCRIPTION.

Railroad, automobile, and carriage and wagon axles are the three principal kinds of axles made of iron or steel. To these may be added axles for small tram cars for industrial purposes, for bicycles, for children's carriages, and other light vehicles. Wooden axles come into competition with those made of metal for use in carriages.

The railroad axle is a forged cylindrical shaft carrying the wheels, and upon which the truck of the car, locomotive or tender rests. The wheels are set rigidly upon the axle, and held from moving inward by a slight flange on the axle. The part of the axle inclosed in the hubs of the wheels is called the wheel seat. The ends of the axles project beyond the wheels. Just beyond the wheels rest the journals, which carry the truck of the cars, and within which the axles turn. That portion of the axle resting within the journal is slightly smaller than that between it and the wheel, thus holding the axles and wheels in place between the journals. Beyond them the ends of the axle project into a journal box containing the oily waste by means of which the bearing between the axle and the journal is lubricated. The axle between the wheels is usually tapered toward the center.

Unlike the railroad axle, the front axle of an automobile is fixed rigidly to the springs of the body of the car and does not revolve. At either end it holds the hubs, on which the wheels revolve, by means of knuckles which allow the hubs to be deflected so as to change the position of the wheels and steer the car. The rear axle of the automobile is not a continuous axle, but is in two parts, one end of each fixed in and revolving with the wheels, the other end fitted with gearing which meshes with that of the shaft midway between the wheels. It is through these gears and axles that power is transmitted to the wheels.

ome carriage axles and the axles of many small vehicles are made ron or steel in a variety of different ways and from different ma- ials, varying from the high grade steel of the bicycle axle to that the cheapest kind of children's cart. These axles are usually d rigidly to the vehicle, the wheels revolving upon hubs at the ls of the axles.

DOMESTIC PRODUCTION.

Quantity.—In 1909, 102,348 long tons of iron and steel axles were duced, an amount slightly less than that made in 1899. Pro- tion in 1914—89,436 long tons—was somewhat greater than t in 1904. In 1909, the product was valued at $3,831,344, and 1914 at $3,407,271.

The figure for 1914 includes 1,160 tons, valued at $96,069, of es other than railroad, forming 1.3 per cent of the tonnage and per cent of the value.

These figures are confined to the production in steel works and ling mills and forging plants, and do not therefore represent the al production of iron and steel axles. Railroad axles are manu- tured in such establishments, but the manufacture of other iron d steel axles is carried on largely outside of rolling mills—in auto- bile factories for instance. The figures thus cover only railroad les and that part of other iron and steel axles which are made in ling mills.

Methods and processes.—Axles may be rolled, hammered, or essed. The rolling process does not work the metal with sufficient oroughness to produce an axle satisfactory under present usage.[1] The axle is forged to shape in a single heat either under the steam mmer or in a high-speed forging press, and then allowed to cool. is then reheated and quenched; reheated a second time and allowed cool uniformly. The details of this quenching and tempering ocess are arranged to produce those qualities in the steel which e especially desired in an axle.

After the heat treatment the axle is taken to the machine shop, here it is cut to length and centered. It is finished by turning.

The wheel seats are made the exact diameter or slightly larger than e hub of the wheels into which the axles are set. The usual rule that the axle be turned one one-thousandth of an inch larger in ameter than the bore of the hub per inch of the diameter of the ore. The setting of the wheels on the axles is done by means of ydraulic pressure, either applied to the wheel, to force it on to a gidly held axle, or to the axle, forcing it into the wheel.

The forging of automobile axles is more open to the use of machine rocesses. The steps in forging a Ford front axle illustrate these rocesses. The front axle is made from a vanadium steel bar 1⅛ ches in diameter and 67¾ inches long. One end of the bar is heated d forged at a time. This is inserted in a forging machine which ips it firmly between dies, while a plunger advances, forcing the etal into them, thus giving it the shape desired. The first dies rm two enlargements in the rod, where the knuckles are to be ade and the springs are to be attached. In the next step the

[1] Formerly the census distinguished between rolled and hammered axles, but has not done so since [illegible] after a very marked decline in the number of rolled axles had been shown, 1900-1905.

dies bend the material at the ends of the rod so that it will be in position to form the knuckles. The end of the axle is then reheated and again inserted in the machine, which shapes it more nearly to the shape of the finished axle. These operations are repeated for the other end of the axle, and the forging is cleaned of the fins before passing to the regular drop-forging operations. The final forming is done under the steam hammer. The axle is heated to over half its length, and laid in the lower die of the steam hammer. Two blows are struck by the hammer. The fins are then removed, and the axle struck a final blow and laid to cool off in the sand. The other end is then similarly treated. Then the axles are taken to a furnace, reheated, placed in a fixture held upon a punch press and stretched to exact size—52¼ inches.[1]

Materials and equipment.—The railroad axle is made from the bloom or the billet. The purchaser usually specifies that a certain minimum discard shall have been made previously from the ingot in order to insure good steel.

The Master Car Builders' Association standard specifications for passenger and freight equipment (1914) provided that axles be made of open-hearth steel having the following composition:

	Per cent.
Carbon	0.38–0.48
Manganese	.40–.60
Phosphorus, not over	.05
Sulphur, not over	.05

The American Electric Railway Association specified (1915) that unless otherwise stated the material for the manufacture of axles be open-hearth steel of the following composition:

	Per cent.
Carbon, not over	0.60
Manganese	0.40–.80
Phosphorus, not over	.05
Sulphur, not over	.05

Localities of production.—Pennsylvania is the chief producing State. In 1914 it manufactured 61,920 tons of iron and steel axles valued at $2,515,703, forming 69.23 per cent of the total tonnage produced by the steel works and rolling mills in the United States and 73.83 per cent of the value. In that year there were seven establishments manufacturing iron and steel axles in Pennsylvania and one each in New York, Ohio, and Indiana.

Domestic exports.—Iron and steel axles are not separately specified in the export statistics. In 1918 they are included with car wheels and the total export of these two articles is valued at $5,220,704.

IMPORTS.

Quantity.—The importation of axles since 1900 reached a maximum of 1,014 long tons, valued at $114,987, in 1911. Since then they have fallen off: For the three years 1912–1914, the average yearly import was 196 tons, valued at $23,010; for the three years 1915–1917, 64 tons, valued at $8,757. None were imported in the fiscal year 1918. Importation began again late in 1918, and in the calendar year 1920 amounted to 141 long tons, valued at $107,119.

Classes and varieties.—The statistics of imports do not specify the different varieties—railroad, carriage, automobile, etc.—of axles in

[1] Hamilton, Douglas Thomas: Machine Forging, pp. 16–21.

. Axles imported fitted in wheels are included under railway
.

racter.—Previous to the war, the imports were continuous, but decreased steadily from 1911 to 1918, but increasing after the ice. In 1914, they were equal to 0.15 per cent of the produc- a relatively small amount.

enue.—The revenue shows a movement similar to the trend in ts. It reached its highest, $17,030.75, in the fiscal year 1911, ing in the following years. For the three years 1912–1914 it ged $3,221.55 yearly; for the years 1915–1917, $875.70. In 1920 venue amounted to $10,712.

re has been a decided decrease in the rate of duty collected the last three tariff acts. That of 1897 provided a specific quivalent to approximately 20 per cent ad volorem; that of one equivalent to approximately 15 per cent. The act of 1913 10 per cent ad valorem duty. (Page 62.)

TARIFF HISTORY.

ited States.—Prior to the act of 1913 the duty on iron or steel was specific. Under the act of 1883 it was 2½ cents per pound, upon "iron or steel axles, parts thereof, axle bars, axle blanks, gings for axles." By the act of 1890 the duty was lowered to s per pound and a proviso added that axles inserted in wheels l bear the same duty as the wheels—then 2½ cents per pound. ct of 1894 reduced these rates to 1½ and 1¼ cents per pound. 1897 the carriage manufacturers called attention to the fact the specific rates, falling on high-grade carriage axles, which light in weight, resulted in the collection of a duty at a very l valorem rate. In the act of that year, the provision laying a ic duty on axles was limited to those axles valued at 6 cents ound or less, while the more expensive axles fell under the 45 nt ad valorem duty provided for manufactures of iron and steel. pecific rates provided were 1 cent per pound on axles and 1½ on axles inserted in wheels. Under the act of 1909, these rates lowered to ¾ and 1¼ cents per pound.

eign duties.—The United Kingdom admits iron and steel axles France levies a duty of 1.05 cents per pound on straight axles led for railways or tramways if rough; 1.66 cents per pound if d. On crank axles the duties are 1.57 and 2.63 cents per l according as the axles are rough or worked. The duty on obile axles is 2.10 and 2.89 cents per pound, respectively, for classes. The German duty is 0.33 cents per pound upon rail- xles. On other axles of iron and steel it is 2.60 cents per pound patent and semipatent axles, 1.30 cents per pound on worked, .65 cents per pound on unworked.

ada levies a duty of 42½ per cent ad valorem on iron and steel The Cuban duty is 0.27 cents per pound on straight axles .64 on bent. Japan places a duty of 0.90 per pound on loco- e axles, and of 0.56 cents per pound on other iron and steel The Argentine duty is 0.95 cents per pound.

Iron and steel axles—Prices (wholesale or retail), purchase, Pennsylavnia Railroad. (Testimony before the Pennsylvania Public Service Commission, Mar. 7, 1917.)

[From Engineering News, vol. 77, p. 512, Mar. 29, 1917.]

	Cents per pounds.
1914	1.5
1917	4.1

Iron or steel axles—Rates of duty.

Act of—		Tariff classification or description.	Rates of duty, specific and ad valorem.
Year.	Par.		
1883....	166	Iron or steel axles, parts thereof, axle bars, axle blanks, or forgings for axles, without reference to the stage or state of manufacture.	2½ cents per pound.
1890....	154	Axles or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture.	2 cents per pound.
		Provided, That iron and steel axles * * * fitted into wheels, or parts of wheels, of iron or steel.	Same rate as the wheels (2½ cents per pound).
1894....	127	Axles or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture.	1½ cents per pound.
		Provided, That iron and steel axles * * * fitted into wheels, or parts of wheels, of iron or steel.	Same rate as the wheels (1½ cents per pound).
1897....	143	Axles or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture, valued at not more than 6 cents per pound.	1 cent per pound.
		Provided, That iron and steel axles * * * fitted into wheels, or parts of wheels, of iron or steel.	Same rate as the wheels (1½ cents per pound).
1909....	142	Axles or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture, not otherwise provided for in this section, valued at not more than 6 cents per pound.	⅝ cent per pound.
		Provided, That iron and steel axles * * * fitted into wheels, or parts of wheels, of iron or steel.	Same rate as the wheels (1½ cents per pound).
1913....	121	Axles or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture, not otherwise provided for in this section.	10 per cent.
		Provided, That iron and steel axles * * * fitted into wheels, or parts of wheels, of iron or steel.	Same rate as the wheels (20 per cent).

COURT AND TREASURY DECISIONS.

The commercial character of importations does not depend upon the mere fact that they were or were not finished axles or whether they were understood and recognized in commerce and in trade as axles by those engaged in such trade at the time of the passage of the act. (Ross *v.* Fuller, 17 Fed. 224, of 1883.)

Nuts, bolts, boxes, etc., actually fitted and attached to axles at the time of importation, but not boxes, wrenches, or other articles not so fitted and attached, were held properly classable under the provision in the Revised Statutes, Schedule E, section 2504, for "axles or parts thereof." (Appeal, T. D. 3207.)

Forgings for car axles were likewise held dutiable under that provision of the Revised Statutes. (Appeal, T. D. 5310, reversing T. D. 4898.)

In determining whether pieces of iron formed in a shape and size to be used as axles in the manufacture of railroad cars were properly classified as axles instead of as hammered iron, the court declared that the commercial character of the importations did not depend upon the mere fact that they were or were not finished axles, but whether they were understood and recognized in commerce and trade as axles by those engaged in such business at the time of the passage of the law. (Ross *v.* Fuller, 17 Fed. 224.)

Bicycle axles of steel were held dutiable as axles and not as manufactures of metal under the act of 1890. (G. A. 2220, T. D. 14291.)

Shafts for grindstones were held not to be axles but dutiable as manufactures of metal n. s. p. f., under the act of 1894. (G. A. 3326, T. D. 16807.)

Steel engine axles, in default of proof of fitness only to be remanufactured, were held dutiable as axles under paragraph 121 of the act of 1913, and not exempt as scrap steel. (Abstract 40380.)

Under the act of 1909 scrap iron and steel had to be fit for remanufacturing by melting, and worn-out car and locomotive axles were held to come within this provision and not to be dutiable as axles in G. A. 7003 (T. D. 30489).

See also upon this subject tariff survey upon scrap iron and steel.

MISCELLANEOUS.

TARIFF HEARINGS.

[1893, pp. 402-408.]

W. C. Dalzell, of South Egremont, Mass., stated that the duty on axles was unjust in that it was a specific duty which admitted light, high-quality carriage axles at a very low ad valorem rate—about 7 per cent when it ought to have been 45.

Theodore Gray, of the Tomlinson Spring Co., Newark, N. J., supported the change to an ad valorem duty.

[1896-97, pp. 262-263.]

Sheldon Axle Co.; Mount Carmel Axle Works, New Haven, Conn.; Dalzell Axle Co.; Tomlinson Spring Co., Newark, N. J., petitioned for a 45 per cent rate on carriage and vehicle axles, for the 1¼ cents per pound on such axles equaled only 10 per cent. It furnished enough protection for car and locomotive wheels.

W. G. Park, of Liggette Spring & Axle Co., of Pittsburgh, in a similar petition recommended a specific duty of 5 cents per pound.

SPECIAL AXLES.

SUMMARY.

The manufacture of special axles as a distinct industry is peculiar the United States, as European automobile makers and carriage ilders and bicycle manufacturers produce their own axles. The nited States is the largest producer, and owing to the enormous velopment of the automobile industry in this country, the American me market for these axles is much larger than that of any other untry. The great home market has fostered the development of ge, well-equipped establishments, several of which do a business from $2,000,000 to $10,000,000 annually. There are no statistics to the production, but it is manifestly very large.

Special axles are produced in various other countries, England being ubtless the largest foreign producer. Foreign competition in the nerican market, however, has never been important and imports ve consisted chiefly of bicycle axles. There are no statistics to ow the actual imports, bicycle axles being commonly imported as rts of bicycles and other axles being grouped with railway axles the Department of Commerce's figures. According to statements manufacturers, there are practically no foreign automobile axles ported. The American output, therefore, somewhat exceeds the mestic requirements and could be largely increased. There is a all export trade in addition to the axles fitted in automobiles and actors which are exported.

American manufacturers are at no disadvantage under present nditions in securing their raw materials, and while American wages e much higher than those paid abroad, the cost of manufacture is ubtless lower in this country, owing to more efficient production ethods made possible by larger outputs and better standardization.

The tariff act of 1913 evidently contemplated only railway axles. utomobile and other special axles are a much more recent develop- ent, and, even in 1913, were a far less important item as compared ith railway axles than they have since become. There is an anomaly the admission of even the plain special axle at the same rate as the latively cheap railway axle which is made from comparatively low- ade steel. The term "axle," however, may be interpreted to mean completely assembled automobile axle with bearings, gears, etc., as ell as the housing. Thus roller bearings, which are specifically utiable at 35 per cent under the 1913 act, may be admitted when ted to an axle at 10 per cent. This anomaly was avoided in the acts 1897 and again in 1909 by inserting the phrase "valued at not more an 6 cents per pound" in the axle paragraph, thus throwing special les as a class among articles n. s. p. f., which were dutiable at 45 r cent in 1909.

Statistics are not available, special axles being included with rail- ad axles.

General Information.

PARAGRAPH 121, TARIFF ACT OF 1913.

Axles, or parts thereof, axle bars, axle blanks, or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture, not otherwise provided for in this section, 10 per centum ad valorem: *Provided*, That when iron or steel axles are imported fitted in wheels, or parts of wheels, of iron or steel, they shall be dutiable at the same rate as the wheels in which they are fitted.

DESCRIPTION.

This survey deals with special axles, particularly automobile axles, whether or not fitted with gears, bearings, housings, etc. Railway axles are covered in a separate survey.

"Special axles," as covered in this survey, include all axles other than railway axles, and especially automobile axles, axles for bicycles and for motorcycles, together with axles for horse-drawn vehicles. The main difference between railway axles and automobile axles is that a railway axle is a single piece of forged steel, relatively simple in form, and to which wheels may be fastened. It has neither gears nor complicated bearings, and is relatively bulky with respect to its value. Automobile axles, on the other hand, may be completely assembled, including bearings and gears. In a complete rear axle brakes may be attached, while the front axle of an automobile may be fitted with steering gear. Manifestly such highly frictioned and intricate axles were not contemplated in the framing of the 1913 tariff act. Carriage axles are relatively simple and may be included as products more or less similar to railway axles. But the conditions of supply, the degree of manufacture, and the uses of special axles treated in this survey are widely different from the axles which were evidently contemplated when the act of 1913 was written.

The chief consumption of these special axles is in the automotive industries. There are from 15 to 20 different models of the automobile axle. The front axle is ordinarily fastened rigidly to the springs of the body of the car and does not revolve. It heats and it holds the hubs on which the wheels revolve. These hubs are attached by knuckles which permit steering, changing the position of the wheels without moving the main axle. The live rear axle of an automobile is commonly in two parts which are surrounded by housings. Each half of the live axle revolves with the wheel which is attached at one end. Differential gears are attached to the other end of the axle which comes at the middle of the car. These mesh with the gears attached to the shaft coming from the engine. Suitable bearings must also be provided for the axle, together with the brake mechanism.

DOMESTIC PRODUCTION.

The manufacture of special axles may in general be considered an outgrowth of the automobile industry, due to the fact that the United States dominates the world trade in automobiles. It has of necessity also become the largest manufacturer and consumer of special axles for use in all classes of motor vehicles. Statistics of production are not available.

Raw material.—Whereas railway axles and even carriage axles are dinarily made from straight carbon steel produced by the Bessemer, en-hearth, or duplex processes, special axles are frequently made m alloy steel of which chrome vanadium and chrome nickel are e most common. Bicycles axles are generally made of a special ality of carbon steel, and good quality straight carbon steel is casionally used in automobiles. In the completely assembled le various metal stampings of aluminum, copper, tin, or steel are ployed. Roller bearings or ball bearings and gears are generally ught from other manufacturers together with various kinds of ews. Since special axles are subject to great strain and shock, e steel must be both strong and tough. Uniformity in composition absolutely essential so that not only a high quality of raw material ust be employed, but it must also be heat treated to obtain the best sults. In general it may be said that the American manufacturers e at no disadvantage as compared with their foreign competitors obtaining their raw materials.

Equipment.—Axles and crank shafts are frequently produced in the me establishment, the equipment then including forging machinery d heat-treating furnaces, in addition to the variety of machine ols requisite for shaping and finishing the axles and component rts. The American manufacturer is not at a disadvantage in the iginal cost of his plant. All classes of machine tools are made in e United States in ample quantities, and in general American signs and quality are equal or superior to those made abroad and ay be obtained more cheaply in this country than elsewhere.

Methods of production.—In general the operations may be divided to (1) forging, (2) finishing, and (3) assembling. A few simple les are made from rolled stock and gears may occasionally be cast. rtain parts and the housings are made by stamping or pressing e metal between dies. But in most classes of axles used in auto- biles the stock for the axle proper is first forged and then finished machine tools. In American plants the work is ordinarily done semiautomatic machinery, but on account of the great number operations which are performed on different machines labor con- tutes an extremely important factor in the cost of production.

Illustrative of the manufacture of automobile axles the following scription of the manufacture of a Ford front axle may be given: e raw stock is vanadium steel bar 1⅝ inches in diameter and 67¼ hes long. One end of the bar is heated and forged at a time. e hot end is inserted into a forging machine which grips the stock nly between dies, while a plunger forces the plastic metal into the s which give it the shape designed. The first operation is to form r enlargements of the bar, one for each of the knuckles and at the o places where the springs are to be attached. In the next step e dies bind the material at the end of the rod, so that it will be in sition of form the knuckles. The axle is then reheated and again serted into the machine where it is now shaped more nearly to the m of the finished axle. Both ends of the axle-blank having been ughly formed in the forging machine, the fins are cut off and the le is finally formed under the steam hammer. The axle is heated er half of its length and then laid in the lower die of a steam mmer, then is struck 10 times by the hammer. The fins from this

operation are removed and the axle struck a final blow before being packed in sand and allowed to cool. The other end is then similarly heated and shaped. The completely formed axle is again heated in a furnace and placed in a jig fixture in a punch press, where it is stretched to the proper size.

Organization.—The American output of axles comes from a great number of plants, many of them extremely large. The efficient conduct of the business calls for a considerable output of the same model, since parts must be interchangeable. Very expensive dies, patterns, tools, etc., are required in order to insure complete interchangeability of parts. The expenditure for such equipment can not be absorbed by a small output. Due to the enormous demand from the automobile industry American manufacturers, as compared with those in foreign countries, have the advantage of a larger market. Fully 85 per cent of the world's automobiles are owned in the United States, and the production in this country far exceeds that of all the rest of the world together.

Another factor is the common practice in this country of specification of output, whereas automobile axles abroad are generally produced by the automobile manufacturers themselves. There is a considerable business in the United States in the manufacture of special components for automobiles, and axles constitute an important item in this business. The larger American automobile companies manufacture their own axles, but the medium sized firms purchase them from other firms which specialize on axles, crank shafts, and other products whose manufacture requires similar equipment.

It is impossible to give figures which will report the total amount of capital invested in the manufacture of special axles. That it is large is certain, as shown (1) by the value of the production and (2) by the comparatively large equipment required. One manufacturer reports a production of nearly $33,000,000 worth of axles for passenger and commercial automobiles in 1919. A manufacturer of internal gear drive truck axles states that the capital invested in his business is approximately $2,250,000 for a capacity of 30,000 axles per year. Another manufacturer making front and rear axles for motor trucks (one-half to 5 tons capacity) estimates the capital requirements in his business at $3,000,000 for $12,000,000 of annual output.

Geographical distribution.—The manufacture of special axles is concentrated in the Eastern and North Central States. Michigan, Ohio, Pennsylvania, Illinois, and New York are the largest producing States, probably in about the order named. There are, however, 6 firms in New England, 9 in Indiana, and 10 or more in various other Middle Western States.

History of the industry.—Manufacture of automobile axles is of comparatively recent and extremely rapid growth. The automobile industry is first mentioned in the census in 1899, and it was then in an experimental stage, and no special axles had then been developed for automobile use. The bicycle axle had been manufactured for several years, and prior to 1900 the bicycle industry was the main consumer of axles equipped with ball bearings. The first commercial steel balls for bearings were made in the United States in 1887, but it was not until the development of the automobile industry that they became of national importance. Even the earlier automobile axles were gen-

lly drop forged, since the hot-rolled process does not work the steel ficiently to give it a satisfactory structure. The axle business was atly stimulated by the war. Among the important improvements ected was the development of a tubular axle instead of the common pe of solid axle.

Domestic production, consumption.—Domestic manufacturers are a position to supply any probable domestic requirements in all sses of axles and are also able to produce a fair surplus for export. ace 1913 production of all classes of axles except axles for horse-awn vehicles has increased greatly. Illustrating the growth of the dustry reports furnished the Tariff Commission by manufacturers ow that one concern produced 5,000 front and rear truck axles in 13 and 20,000 in 1919. Another concern produced in 1919, 3,000,000 worth of automobile axles valued at $150 to $800 per t. Another company produced 10,100 motor truck axles valued $2,700,000 in the same year. Owing to the depression in the auto-obile trade in the third and fourth quarters of 1920, the production this year will probably show a reduction from the 1919 output spite of the activity during the first six months.

DOMESTIC EXPORTS.

There are no statistics showing the export of special axles, as they e included with railway and other axles in the Department of mmerce's records. It is known, however, that these axles are ported in a small way to a number of countries, partly for the pair of American-made cars and partly for use in the manufacture foreign automobiles. No important trade with foreign automobile akers, however, has yet been developed. American manufacturers eet foreign competition in many neutral markets on even terms, it apparently have no special advantages.

FOREIGN PRODUCTION.

In most foreign countries the manufacture of automobile axles is ot a distinct industry. Since they are almost invariably made in e automobile factories in which they are consumed, there are no atistics of production but, judging by the output of automobiles, e principal foreign producing nations are Canada, France, England, aly, Germany, and Belgium. At the present time England is oubtless the largest foreign manufacturer.

IMPORTS.

Automobile axles and all special axles are included with railway cles in the Department of Commerce classification. According to atements of domestic manufacturers the imports of special axles e negligible. Several manufacturers stated positively that there e no imports.

PRICES.

On account of the variety of size and type of axles it is manifestly possible to present detailed price data. One manufacturer of tomobile axles reports that he makes axles for sale at $170 to 00 a set and the total range is doubtless considerably greater an that between the products of any one manufacturer. Prices

have generally advanced, of course, since 1913. For example, a certain motor truck axle which sold in 1914 at $179 was quoted in November, 1920, at $330. Another truck axle was priced at $330 per set (front and rear) in 1913 and at $500 per set in 1919.

According to statements made to the commission, foreign prices are invariably higher than domestic prices.

TARIFF HISTORY.

The tariff act of 1894 imposed an import duty of 1¼ cents per pound. The act of 1897 reduced this to 1 cent a pound, inserting the provision "valued at not more than 6 cents a pound"; this threw axles valued at over 6 cents a pound among articles n. s. p. f. dutiable at 45 per cent ad valorem. The act of 1909 contained the same wording, reducing the duty to three-fourths of a cent per pound, and also imposed a duty of 45 per cent ad valorem on metal articles n. s. p. f.

The act of 1913 included all axles under an import duty of 10 per cent ad valorem. The effect of this may be to allow the complete automobile axle fitted with gears, roller bearings, housings, etc., to come in on the same basis as the simple railway axles. The provision of the acts of 1897 and 1909 fit the present development of the trade in this respect better than the act of 1913. Statistics do not show the different classes of axles and the effect of the above duties on the duties collected on special axles can not be stated. However answers to questionnaires state that there are no imports of automobile axles.

COMPETITIVE CONDITIONS.

Under present conditions the American manufacturer of axles has an overwhelming advantage, due to his extensive equipment and large home market. His raw materials cost him no more than those supplied to his foreign competitors, and, while American labor in this industry is paid almost double the wages paid in England, where wages are much higher than on the Continent, the labor cost in the production of these articles is probably lower in the United States than anywhere else in the world, owing to efficient factory methods and equipment. An important factor in the competitive position is the standardization of the American production, which permits complete interchange of parts in axles. It would be difficult for a foreign manufacturer to introduce extensive competition unless he maintained sufficient stock in this country to supply any sudden demands.

American wages have increased approximately 100 per cent since the outbreak of the war. The following comparison is reported by a plant in Michigan:

	Hourly wages.	
	Prewar.	Nov., 1920.
Common labor	$0.225	$0.[illegible]
Machine operators	.275	.[illegible]
Tool makers	.350	.[illegible]

UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 123, 124, and 125 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

IRON CASTINGS, NUTS, WASHERS, BOLTS, HINGES, SPIRAL NUT LOCKS AND LOCK WASHERS, RIVETS, STUDS, AND STEEL POINTS

agraph 123:
Nuts, Washers, Bolts, Hinges, Spiral Nut Locks and Lock Washers

agraph 124:
Card Clothing. (See par. 111)

Paragraph 125:
Iron Castings.

Paragraph 138:
Rivets, Studs, and Steel Points

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PREFACE.

This is one of a series of tariff information surveys prepared by the nited States Tariff Commission and transmitted to the Committee Ways and Means. The series covers all of the articles and com-odities provided for in the tariff act of October 3, 1913, and others t specifically provided for. It is arranged in the numerical order paragraphs of that act.

In some cases two or more paragraphs have been combined in one mphlet. In doing this, industrial relationship of the articles has en followed when possible. In those instances where a paragraph s been treated under a preceding paragraph of the tariff act, erence is made to this fact at the point where the paragraph pears in numerical order. Where one grade of an article is dutiable d another grade of the same article is on the free list, the article discussed under the dutiable paragraph, which appears first in merical order in the tariff act. In certain instances articles of se industrial relationship and which occur in separate paragraphs the tariff act have been combined under one paragraph for con-nience of discussion. Reference is made to this fact at the point ere the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," ich contains:

1. An introductory chapter discussing the scope of the series and e general method of treatment.
2. An alphabetical index of the articles provided for in the tariff t of 1913, showing the paragraph of the act in which the article is ovided for and, if discussed under a different paragraph, the number such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs d articles included in each pamphlet.

Thus by use of this "Introduction and Index," the exact location the discussion relating to a given article or commodity can be certained.

In the preparation of this report the Tariff Commission had the rvices of H. J. Bierman and L. A. Rufener, of the metals division the commission's staff, and of others.

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IRON CASTINGS.

SUMMARY.

Iron castings are shapes formed from the molten metal by pouring into molds of sand or metal. Castings are cheaper than forged apes and the extra weight necessary to insure the required rength does not usually counterbalance this advantage. Cast iron used for bedplates, heavy machine castings, pipes, and an infinite riety of special parts, the more important of which are stove stings and hardware castings.

Forged shapes and steel castings are replacing cast iron to some tent, especially for uses where strength is an important conderation and the weight must be kept at the lowest possible limit. e iron castings or foundry industry in the United States is largely ıfined, as it is in most foreign countries, to serving localized demands. e heavy castings and shapes are of little value per unit of weight that the freight rates are an important factor in the competitive ition.

The smaller castings are specialties which have no staple interional market, but are made up on order to suit customers' conıience. Some articles, such as pipe valves, the globes of which are de of cast iron, enter international trade to a considerable degree, t as these have been machined and consist of machined parts, as ll as of castings, the finished material is not classified in the tariff castings.

No exact figures regarding domestic production of castings are ailable, but competent authorities estimate the production at not s than 6,000,000 tons per annum.

Foreign competition is of little importance in the domestic market, d in foreign markets, outside of Europe, domestic producers do t appear to be at a disadvantage. Statistics are not available for nparison, but from such figures as are available, it appears that gland imports more than she exports and that the United States ports an average of 1,000 tons a year to England. Alabama oducers of cast-iron pipe hold the domestic Pacific Coast castn market, although ocean freight rates have been favorable to ropean manufacturers. Canada imports considerable iron castings m the United States and very little from England. Before the r a large part of English imports of iron castings originated in rmany.

GENERAL INFORMATION.

ACT OF 1913.

Paragraph 125. Cast-iron pipe of every description, cast-iron dirons, plates, stove plates, sadirons, tailor's iron, hatter's irons, d castings and vessels wholly of cast iron, including all castings of n or cast-iron plates which have been chiseled, drilled, machined,

or otherwise advanced in condition by processes or operati subsequent to the casting process, but not made up into articles finished machine parts; castings of malleable iron not specia provided for in this section; * * * 10 per centum ad valorem.

Section 4. Paragraph J, subsection 5, provides for importation fr of duty for material and supplies for vessels; paragraph 167, artic or wares not specially provided for in this section; if compos wholly or in part of * * * iron * * * and whether partly wholly manufactured, 20 per centum ad valorem.

DESCRIPTION.

Castings are metal objects that receive their shape from molds i which the iron is poured in a molten condition, and there allowed solidify. The verb "casting" means the operation of filling mol it is also called teeming or pouring. The place where molds a castings are made is called a foundry.

Gray iron castings contain carbon in the free state (graphitic c bon); mottled cast iron contains free and combined carbon; and wh iron, only combined carbon. Steel contains combined carbon, difference between steel and white cast iron being that the for contains much less carbon and silicon, and usually less phospho although special low phosphorus cast iron may contain less phospho than some steels.

Iron castings can not be rolled or forged. Being cheap, as c pared with steel, cast iron can be used in generous proportions in large sections, so as to assure the necessary strength.

Pig iron is sometimes called cast iron because in the early d of iron manufacture all castings of iron were made direct from furnace. "Direct metal," however, is unreliable and only ingot mo heavy castings, and, in Europe, some classes of pipe, are made di from the blast furnace. Hence "cast iron" to-day means "r castings." This survey deals with iron castings made from pig and scrap remelted, generally in a cupola, and cast in a mold. iron cast unconverted, as in iron castings, contains a consider percentage of carbon and silicon and less manganese, phosphorus, sulphur. These elements influence the qualities of the iron casti They differ in this respect from steel castings from which almost of these elements are eliminated.

Carbon.—The condition of the carbon is most important. I carbon, as in gray iron, produces softness and makes the iron ea machined; combined carbon produces great hardness, as in mot and white iron.

Phosphorus makes cast iron fluid, but brittle when cold. I needed to permit the molten iron to flow into delicate or intri patterns, as with stove castings, hardware, etc.

Silicon influences the formation of graphitic carbon, thus softe the iron.

COMMON FORMS OF CAST IRON.

Malleable cast iron combines the qualities of wrought iron and s with the fusibility of cast iron and can be cast into intricate sha It is malleable when complete because of the change of the carbo the American practice and its removal in European practice.

ner is of the "black heart" variety and is applicable to thicker tions than the latter, which is called the "white heart" variety l is limited to thin sections.

The approximate chemical composition of malleable cast iron is: rbon, 2.50 per cent; silicon, 0.75 per cent; manganese, 0.25 per cent; phur, 0.06 per cent; phosphorus, 0.19 per cent; the balance being n. It can be flattened out and bent double without cracking.

Malleable cast iron is used largely for railway equipment, e. g., pler, journals, etc., as it has resistance to repeated stresses and cks. Steel castings are replacing it now to some extent. It is o used for agricultural machinery, for pipe fittings, household and ness ware; even hammers, skates, wood chisels, etc., are sometes made of it. The "black heart" variety is generally employed.

CAST-IRON PIPE.

Cast iron is used extensively for pipe for water, oil, and gas supply stems. It is thicker than steel pipe, because of the difficulty of ting thin sections and because of its brittleness and weakness; t being thick it is more durable than steel pipe, even though the e of oxidation is the same. It is preferred to steel pipe for many s. The bulk of the product is bell and spigot pipe, made with a l socket at one end and the other end adapted to fit into the bell a contiguous section.

Centrifugally cast-iron pipe is a new and superior kind and can be t in thinner sections. Canadians have secured the world's rights this process.[1] Electrically treated cast-iron pipe is a new and portant product. The pipe after annealing resists corrosion better an ordinary cast-iron pipe, is tougher and much stronger, and is of ner structure. It has a tensile strength of 39,000 pounds per uare inch compared with 16,000 pounds of the other kind of castn pipe.

Sadirons, tailor's irons, and hatter's irons are composed of a castn base, polished on its underside and fitted with a wrought iron steel handle.

Stove castings are another important product, made generally in cial foundries. Stoves are made of thin sections and of fancy, ricate patterns; these castings are brittle, as high phosphorus iron used for fluidity, so that the molten iron can flow into the thinner tions of the mold.

Hardware castings are also of thin section and intricate design. mestic producers have developed this product to a high degree of rfection; castings of this kind have a fine finish. When strength desired they are of malleable cast iron.

Semisteel castings are made of pig iron and steel scrap. They con- n less free carbon than ordinary iron castings and are stronger; on machining they take a fine finish. They are made in iron undries and should be classed with iron castings. Just before the ning of the armistice the Ordnance Department of the United States my was arranging for the manufacture of 300,000,000 semisteel ells and invited practically all the larger iron foundries to cast the ell blanks, as all available rolled and cast shell steel capacity had en contracted. This was a French idea.

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[1] Iron and Coal Trades Review, Dec. 10, 1920, p. 797.

Machine castings form a large percentage of the total. As machine castings are combined with rolled and forged parts, no statistics of the tonnage produced are available. They must be soft and strong and easily machined. The ideal strong machinery casting chemical formula, deduced from the Woolwich, England, experiments, is as follows: Carbon, 4 per cent; silicon, 2.75 per cent; manganese, 0.50 per cent; sulphur, 0.04 per cent; and phosphorus, 0.50 per cent.

USES.

There are innumerable uses for iron castings, which differ principally in form. Uses other than those above described are for air, ammonia, and hydraulic cylinders, pistons and rings, annealing boxes, bed plates (for machinery) and frames, brake shoes, crusher jaws, electrical castings, flywheels, gears, grate bars, cannon (almost obsolete), ingot molds, locomotive and car castings, ornamental work, fittings, plow points, pulleys, pumps, chilled and sand cast rolls, furnace castings, valves, air-brake parts, radiators, and automotive parts. The automotive industries are important users of malleable-iron castings in car parts and accessories and for hubs and rear axles. Iron castings are also used where resistance to corrosion is important. Railroads are large users of malleable-iron castings; agricultural implement makers, machinery and engine manufacturers employ gray iron castings in large tonnages; gas and water plants, as well as plumbing and heating equipment makers, consume great amounts of cast-iron pipe; engine, pump, and automotive works use high-grade cylinder castings.

Sash and other weights have no quality other than weight, and inferior scrap iron is used in their manufacture. They do not enter into international trade to any considerable extent.

SUBSTITUTES.

The following substitutes for iron castings may be mentioned: For cast-iron pipe, wrought iron and steel pipe; for stove castings, sheet iron and steel; for iron castings requiring great strength, steel castings or forgings or fabricated structural shapes; for straight simple sections, rolled iron or steel plates; for cast-iron cylinders, automotive cylinders made of forged steel. It may be said in general that rolling and forging and steel casting are substitutes for the iron-casting process, as originally all iron was cast and not converted into steel or wrought iron. Iron castings are used where strength and lightness are not the main requisites, cheapness being the first consideration. The substitutes are more costly and are used where strength and lightness are the important considerations.

DOMESTIC PRODUCTION.

The census of 1914 gives the value of the country's production of cast-iron pipe and fittings as $26,659,000. In 1919 it had increased to $50,235,000.

Statistics regarding the tonnage output of cast-iron pipe and fittings show a decline from 1,266,245 tons in 1913 to 886,515 tons in 1920. A well-known authority states that the production of all kinds of iron castings is about 6,000,000 tons a year.[1]

[1] *The A B C of Iron and Steel*, 3d ed., p. 236.

It is impossible to state exactly what the production is, as there are innumerable small foundries, and much of the tonnage of the larger works is included with wrought iron and steel, as in machinery. The manufacture of iron castings is a very important industry and foundries, large and small, are numerous and widely scattered.

Materials.—The principal raw materials, pig iron, scrap, coke, limestone, and sand are all on the free list. Domestic manufacturers have ample supplies, and compared with foreign manufacturers, are not at a disadvantage with respect to these articles.

Pig iron of various chemical compositions is the base of the industry. For electrically treated cast-iron pipe molten iron from the cupola is taken to the electric furnace.

Scrap cast iron is the second largest item of material used in the mixture to form the molten iron for castings. It is sorted so that scrap machinery goes into machinery castings, stove scrap into stove castings, etc. Scrap made in the works is turned back into the cupola mixture. Burnt scrap iron is objectionable, as it generally has absorbed sulphur and the carbon is not free.

Coke.—Foundry coke is of a higher grade than blast-furnace coke. It is selected and screened and costs more. It must be of large size to keep the charge open; less blast pressure is thereby permitted than when furnace coke is used.

Limestone is used in small quantities and is ordinarily obtained locally. Sand is an important material used in making the molds; it is composed of refractory grains of silica with some loam. Sand burned by the casting is discarded and replaced by fresh sand mixtures.

Clay is mixed with the sand as a binder in about the proportions of one-fifth clay and four-fifths sand. There are numerous mixtures.

Binders of special compositions are used to hold the molds and cores in shape.

Semisteel castings use pig iron and steel scrap in varying proportions. The metal, not being converted into steel, is cast directly.

Ferro-alloys.—Ferrosilicon, spiegeleisen, and ferromanganese are used, but are not important. Where it is necessary to add more silicon and manganese than a ladleful of molten metal can take without undue cooling, it is better to use high silicon and high manganese pig iron, because the pig iron can be melted in the cupola.

It is common practice to dip pipe in asphaltum, paint, or some similar protecting material before the metal is subjected to corrosive influences.

Equipment.—Iron foundry equipment varies with the size of the plant. The larger producers use molding machines which have largely replaced high-priced molding labor and conveyors which carry the molds to the pouring or casting room. Large continuous cupola furnaces eliminate dead time while the furnace is heating and conserving fuel. Electric furnaces are used in some plants for treating iron from the cupola. Centrifugally cast-iron pipe is cast in revolving water-cooled centrifugal molds. Auxiliary equipment consists of pattern shops containing complete wood-working plants for wooden patterns and metal-working shops for metal patterns and forms. Core

rooms contain core ovens to dry and bake the core of the patterns. Electrically heated ovens are a new development in this department, as are also compressed-air core machines. Revolving barrels and sand-blast machines clean the rough castings of adhering sand and nodules of iron. The finished castings are annealed in special furnaces which are regulated so as to give the product any desired physical characteristics.

The equipment described above is found only in the larger plants. Small foundries have little equipment—sometimes only a small cupola lined with fire brick and charged by hand. Small ladles and wooden flasks complete the equipment. Foundries of this type make grates, sash weights, miscellaneous castings, and repair parts. Equipment is all of domestic manufacture—indeed, the little foundry can make everything it needs as it is generally operated in connection with a machine shop.

Molding machines.—The ordinary squeezer of the ponderous jarring machine is largely used. Labor and time are saved and efficiency is realized. Molding machines have been developed for special installations in establishments having a large demand for special shapes of casting of duplicate patterns.

Mold conveyors serve the molding machines and carry the molds before the cupola, where the metal is poured. The molds are dumped over a grating through which the sand drops. The castings are then conveyed to the cleaning places. Continuous cupola melting is practiced with such equipment, and quantity production is secured. Air-brake parts, radiators, pipe fitting, etc., are produced in enormous quantities at a very low cost.

Centrifugally cast iron pipes are cast in revolving water-cooled cylindrical molds. The electric furnace is used for electrically treating iron from the cupola for cast-iron pipe made by this process.

The pattern shop may consist of a most complete wood working plant for wooden patterns and complete metal-working shops for metal-patterns. A pattern of intricate design, true for shrinkage and highly finished, as for automobile cylinders, cost, late in 1920, about $3,000.

Methods of production.—Casting is an old art, the changes in which lie largely in basing the mixtures of iron used on chemical analysis instead of iron fracture. This development has gone far in the United States.[3] Castings for different uses must have different chemical compositions, the more scientific practice insuring better and cheaper results. American malleable iron differs from malleable iron made in Europe. Pig iron and scrap (generally cast-iron scrap but sometimes steel scrap) are combined to meet the required chemical formula. This combination with coke and limestone is charged in a cupola for ordinary castings (in an air or open-hearth furnace for malleable castings) and melted at a low pressure blast from a blower. The molten iron is tapped into a ladle. From this it is poured into molds, which are made of special mixtures of sand rammed about patterns in iron or wooden flasks. A riser or reservoir of liquid metal runs into the pipe formed by shrinkage of the cooling metal; the pressure of this column of liquid metal also forces the metal to fill the thinner sections of the pattern of the mold. The riser is cut off from the cold casting.

[3] *Effect of the Chemical Elements in Cast Iron*, Walter Graham, 1889.

During the solidification of the casting the cooling action proceeds inward from the portion in contact with the walls of the mold and a shrinkage takes place. Gases evolved cause blowholes, and the molds have small perforations which permit the escape of gases. The metal is generally poured from the ladle into a runner at the side or bottom of the mold. This prevents the destruction of the mold surface, which would occur from the falling of molten metal in top pouring. The runner connects with the casting by gates. For such a product as cast-iron pipe, which is cast in vertical iron molds, small molds are set on the floor and the larger molds are placed in a casting pit. Open sand castings are those which are cast in molds formed in sand without flasks. Smoothing or dressing is generally done with a grinding wheel, but the castings, if small, are dressed in a tumbling barrel. Where castings have to be fitted to each other or to some other object, the faces which come in contact are frequently provided with thin metal strips called chipping pieces. These are cut until they fit. A recent interesting development has been adopted by the Ford Motor Co. in connection with their large new blast furnaces. Open-hearth furnaces, in front of the blast furnaces, act as mixers of the molten pig iron, which is poured directly into them. The metal is mixed according to the required formula and the initial heat is conserved and added to by gas through the regenerators. The cupola is not used in this process and both fuel and labor are conserved.

For chilled iron castings for car wheels,[4] rolls, anvils, etc., iron meeting the tests of a special analysis as regards silicon and sulphur (preferably cold blast charcoal iron) is cast against a chilled surface of iron. This method produces glass-hard white iron for about an inch from the surface. The rest of the casting remains gray, tough, and readily machined. White iron can not be machined, is hard enough to cut other metals, and has great wearing qualities, maintaining a smooth surface against severe wear.

Semisteel castings are made by combining a mixture of pig iron and steel scrap, which is melted in a cupola. They are cast either in a sand mold or in a permanent iron mold, washed with a refractory mixture. The mold is promptly opened after pouring and the castings are stacked for annealing. These machine to a high finish and combine the qualities of cast iron and steel, being more malleable and stronger than iron castings.

Cast-iron pipe.—Foundry pig iron of medium grade and carrying considerable phosphorus, with little or no scrap, is melted in a cupola and poured from ladles into vertical iron molds, the core forming the interior of the pipe. After the pipe is cleaned it is tarred, hydraulically tested, and then annealed.

Sadirons, tailor's irons, and hatter's irons are made by inserting a formed handle in the mold and casting the base so that the cast metal holds the handle. The base has its underside polished.

Pipe cast centrifugally.—The specifications for ordinary cast-iron pipe call for tensile strength of 19,000 pounds per square inch. When higher standards are required the metal is apt to be brittle. A new centrifugally cast pipe is now being manufactured, and some consideration is being given to the revision of specifications for cast-iron pipe. In this process centrifugal force is applied to molten iron when poured into a permanent iron mold. A regulated quantity of molten

[4] See Survey on Railway Wheels (C-15).

iron is introduced into a revolving water-cooled cylindrical mold, and the centrifugal force spreads the molten metal uniformly upon the inner surface of the mold.

Malleable cast iron.—Malleable pig iron is melted in an air furnace or open-hearth furnace, to avoid the absorption of sulphur, which occurs in the cupola. The metal is cast into molds. After cooling the fracture is white or mottled in the center, the carbon being combined. The castings are cleaned and reheated to 1,250° to 1,600° F. for 60 hours, which precipitates the carbon as "temper graphite," not in flakes, but like powder. (This is the American practice; European practice is different.) Molding machines are generally used, as malleable castings are ordinarily made in great quantities from the same pattern. After the castings are cleaned in the tumbling barrel, or by sand blast, they are packed with iron oxide in cast-iron annealing boxes and annealed in ovens for six days. This produces a white decarbonized skin.

Organization.—The industry for the most part consists of great numbers of small jobbing foundries. Almost every town has one or more, often connected with a machine shop. For the manufacture of cast-iron pipe, chilled castings, malleable castings, and stove and machinery castings, large factories and capital are employed. These organizations serve a wide market. The capital is scattered among many firms. A combination of 11 cast-iron pipe foundries, with a capital stock of $15,000,000, has been formed. Unlike steel works, foundries are not generally "self contained;" they buy their raw materials instead of producing them. The Ford Motor Co. is an exception. It has built blast furnaces, is developing its own iron ore and coal deposits, and has recently bought a railroad. Its foundry will probably represent an investment of more than $3,000,000. In the case of small jobbing foundries, capital investment ranges down to a few thousand dollars. Malleable cast-iron works, making castings for railroad purposes, are declining, as steel castings are being substituted. The cast-iron pipe works are large, this branch of the industry at one time having been overdeveloped. It is an important branch of the industry, however, as cast-iron pipe resists corrosion better than steel, is less costly, and is strong enough for water pressure. The manufactures are diversified, embracing cast-iron water, culvert, soil, and plumbers' pipe and fittings, couplings, junctions, elbows, tees, etc. The Federal Census of manufactures, 1914, gives the following comparative summary for the United States in the cast-iron pipe industry:

	1914	1909	Percentage of increase
Persons engaged	13,290	12,290	8.1
Capital	$26,981,070	$23,110,318	16.7
Value of products	$30,059,305	$29,153,720	3.1 [1]
Establishments	59	52	.....
Capital:			
With less than $100,000	14	11	.....
$100,000 to $1,000,000	37	28	.....
$1,000,000 and over	8	13	.....

[1] Decrease.

There was a marked decrease in the number of establishments producing cast-iron pipe products valued at $1,000,000; this was probably

due to the depression in iron and steel industries in 1914. Combinations have not been frequent since the era of combinations of iron and steel works about 1900, when the cast-iron pipe "trust" was formed, with blast furnaces and pipe works in Ohio, Alabama, Tennessee, Kentucky, Pennsylvania, and New York. A large part of the cast-iron business is so connected with machinery manufacture, and there are so many scattered foundries of small production, that capital investment in the industry as a whole can not be accurately estimated.

Geographical distribution.—Cast-iron foundries are to be found in almost all towns of any considerable size. The census for 1914 gives the location of cast-iron pipe works as follows:

New Jersey, 9 works, with a tonnage of 263,915 gross tons per annum.

Alabama, 20 works, with a tonnage of 264,411 gross tons per annum.

Pennsylvania, 7 works, with a tonnage of 208,604 gross tons per annum.

Ohio, 8 works, with a tonnage of 152,944 gross tons per annum.

New York, 3 works, with a tonnage of 11,772 gross tons per annum.

All other States, 12 works, with a tonnage of 164,357 gross tons per annum.

As cast-iron pipe is a heavy product, sold generally on large contracts for future delivery, the plants are frequently located on navigable streams or at seaboard to assist shipment by water.

The works making malleable cast iron for railway purposes are generally located at the northern railway centers.

History of the industry.—Originally all iron was cast, and up to the time of the American Revolution cannon, cannon balls, pots, backplates for fireplaces, etc., were cast direct from the blast furnaces. This is still done in producing ingot molds, some heavy castings, and, in Europe, cast-iron pipe. Coincident with modern casting the forging process was developed, and in the latter part of the eighteenth century, Cort of England, developed the rolling of iron. These two processes are the outstanding competitors of iron casting. The coming of railroads caused the establishment of the malleable cast-iron industry. More recently the increase of loads and speed on railroads led to the demand for steel castings instead of malleable-iron castings. The growth of cities, with their gas and water works, and the production of oil and gas created a large market for pipe and fittings. Building machinery also required foundries everywhere. Agricultural machinery likewise has been an important factor in the growth of the cast-iron industry. However, the decline in charcoal supplies has contributed to the substitution of steel for the higher grade iron castings. Some effort has been made to develop semisteel castings. While not a success in car-wheel manufacture, they are being made for other purposes.

In 1722 Reaumer described a process of packing small castings (presumably white) in pulverized hematite iron ore and heating to bright redness for many days to remove carbon. In England this grew into an industry (white heart castings). The English white cast iron was low both in manganese and silicon, conditions being unfavorable to the formation of temper (or graphitic carbon). The annealing treatment removed carbon and resulted in castings approximating the chemical and physical properties of wrought iron. The

American or "black heart" treatment was discovered in 1826 by Seth Boyden. American pig iron is low in sulphur and high in manganese. Decarburization of castings made from this iron was found to be unnecessary, since the graphitic carbon was changed by heat treatment into a powdery form instead of flakes. Black heart or American malleable cast iron bears no metallurgical relation to the European product, and its history begins with Boyden and not Reaumur.[3] The American variety is produced in thicker sections, the European being restricted to thin sections, such as are required for harness fittings.

Domestic production and consumption.—It is exceedingly difficult to ascertain the actual production or consumption of iron castings in the United States. Private estimates place the production at 6,000,000 tons per annum, but the Federal Census gives the production of cast-iron pipes, fittings, and all other indirect castings in 1914 as 1,079,584 tons, valued at $26,659,365. In 1919 this value had increased to $50,235,000. The production of direct castings (cast direct from the blast furnace) was reported by the census of 1914 to be 14,384 tons. The American Iron and Steel Institute estimates the production of cast-iron pipes and fittings in 1914 at 1,160,780 tons, and in 1920, at 886,515 net tons. Statistics of production of malleable machine and agricultural castings, as well as of numberless small foundries, are lacking. It is fairly evident, however, that the domestic iron-casting industry produces sufficient material for the domestic market and, in addition, a considerable but variable surplus for export. The market for machinery castings is largely localized and international trade in these articles is negligible. Cast-iron pipe, on the other hand, is at times exported in considerable quantities. Exports in the calendar year 1920 amounted to 68,417 tons. The reason for international trade in iron pipe is easily determined. The product is standardized and in universal use. Although brittle, it is fairly strong, and the breakage loss is not excessive. Furthermore, as immediate deliveries are not demanded on large orders, slower and cheaper water transportation can be utilized.

Domestic exports.—Statistics are not available to show exports of the iron-casting industry as a whole. Commerce and Navigation gives the following:

	1913 (fiscal year).		1919 (calendar year).	
	Pounds.	Value.	Pounds.	Value.
Radiator and iron heating furnaces	19,207,742	$700,881	10,430,064	$779,253
Pipes and fittings	632,197,033	16,761,540	88,329,704	5,177,732
Iron and steel stoves and ranges [1]	.....	2,146,192	1,703,725	2,696,715
Iron and steel castings [1]	.....	3,564,014	.....	4,998,164

[1] Figures not comparable as they include iron with steel.

The statistics of cast-iron pipe are more complete, showing exports to countries.

An annual average of about 1,000 tons of all kinds of castings has been exported to England for several years past.

[3] American malleable cast iron, Iron Trade Rev., Dec. 2, 1920, p. 1536.

Exports to Canada are considerably larger than to any other country and much larger than those from England to Canada, in spite of the preferential treatment accorded imports from Great Britain. In 1920, of the Canadian imports of cast-iron pipe, 86 per cent came from the United States and 14 per cent from Great Britain. Much of the Canadian trade may be attributed to the relative proximity of this country and a shortage of pig iron and coke in Canadian consuming centers.

FOREIGN PRODUCTION.

Canada produced in 1913 cast-iron pipe to the amount of 96,800 net tons and in 1920 59,850 tons.[6] Austria produced in 1917 26,536 gross tons.[7] Great Britain in 1913 imported 7,665 long tons and exported 5,384 long tons of iron castings. England's production, therefore, does not supply her domestic market. Statistics for other foreign production are not available.

IMPORTS.

Statistics are incomplete and generally include other commodities. Steel castings, the principal substitute, are included with ingots in the figures of Commerce and Navigation and are not comparable.

Imports of malleable iron castings are relatively important. These are specialties used in automotive and other industries requiring material to resist strain and shock. The demand for such commodities has grown rapidly and imports about equal exports. Imports are small compared with domestic production. Exports of all cast products except malleable castings greatly exceed imports.

Cast iron imports are apparently not influenced to any appreciable extent by the tariff. Imports of malleable-iron castings increased from 810,305 pounds in 1908, valued at 5.31 cents a pound and dutiable at an average ad valorem rate of 17.55 per cent, to 1,873,047 pounds in 1913, valued at 4.2 cents per pound and dutiable at 16.62 per cent ad valorem. In the calendar year 1919 imports declined to 1,319,233 pounds, valued at 8.1 cents a pound, dutiable at 10 per cent ad valorem. The largest imports were 6,696,068 pounds during 1920. Imports of cast-iron plates, stove plates, and castings and vessels wholly of iron decreased from 2,304,999 pounds in 1909, with an average ad valorem rate of 10.83 per cent, to 830,984 pounds in the calendar year 1921, dutiable at 10 per cent.

The following figures show imports of different kinds of iron castings in one prewar and one postwar year:

	1913 (fiscal year).		1919 (calendar year).	
	Pounds.	Value.	Pounds.	Value.
Cast-iron plates, etc., chiseled, etc.	1,019,623	$34,158	49,247	$4,307
Cast-iron plates, etc.	1,240,345	40,622	1,559,012	147,607
Malleable cast iron	1,873,047	78,878	1,319,233	107,163
Cast-iron pipe	263,614	4,445	164,945	6,226

[6] Annual Statistical Report, American Iron and Steel Institute.
[7] Mineral Resources, 1917.

PRICES.

Iron castings are special products, varying in value with design and difficulty of pattern making, casting, and finishing. Heavy castings are much cheaper than light ones. Trade papers do not quote prices except for cast-iron pipe. Foreign prices are not available. Cast-iron pipe is a standard commodity and prices are quoted in the trade papers. Prices on this commodity fluctuated from $23.37, per net ton, in 1913, to $73.98 in 1920. The import valuation was $34 in 1913, and $146 in 1921, for "cast-iron pipe of every description." In 1913 the import valuation was $10.63 higher than the domestic price and in 1920, $48.02 higher. The average valuation of all classes of iron castings reported as imported in 1913 was $72.26 per ton, and in 1921 it was $190 a ton.

TARIFF HISTORY.

The act of 1894 imposed duties of 0.6 cent a pound ($13.44 a ton), on cast-iron pipe and 0.8 cent per pound ($17.90 per ton), on iron castings other than malleable, on which the duty was 0.9 cent a pound ($20.16 per ton).

The act of 1897 reduced the duty on cast-iron pipe to 0.4 cent a pound ($8.96 a ton) and left the duties on the other classes unchanged. The act of 1909 reduced the duty again on cast-iron pipe to 0.25 cent per pound ($5.60 a ton), leaving it the same on other iron castings except malleable castings, on which the rate was reduced to 0.7 cent a pound ($15.68 a ton). In addition to the 0.8 cent per pound a duty of 0.2 cent per pound was provided in this act for machined castings. The act of 1913 made the rate on all these classes of castings 10 per cent ad valorem, which in 1918 was equivalent to an average of $6.065 per ton for cast-iron pipe, $15.23 per ton for malleable castings, and $11.424 per ton for other castings.

In the act of 1897 the paragraph on castings included only rough castings, and all castings of iron on which work had been done subsequent to the casting process were classified as manufactures of metal and held dutiable at 45 per cent ad valorem. In the act of 1909 the paragraph on castings was amended so as to include castings on which work had been done subsequent to the casting process, these being made dutiable at 0.2 cent per pound more than the rate on rough castings. Castings made up into articles were not included in this provision. The act of 1913 further restricted the classification by inserting the words "or finished machine parts" at the end of the clause excepting articles.

COMPETITIVE CONDITIONS.

There is little foreign competition in the domestic market. The United States exports more iron castings than it imports. For many years at least there is likely to be very little foreign competition in the domestic market. The factors acting to restrain exports from Europe are connected with the results of the war. There has been general prostration of the iron and steel industry in Germany, destruction of plants in Belgium, high labor cost in England, and shortage of coal in France.

Prior to the war American exporters met competition from Germany and England. Since the war this competition has been materially reduced. English manufacturers have claimed an advantage in South American markets on account of the abnormal rates of foreign exchange.[8] In the export trade, transportation is an important competitive factor. Producers in England have their plants near the seacoast and are, therefore, saved transportation costs which most American producers are obliged to incur in shipping castings from their foundries to the coast.

In the manufacture of iron castings, the cost of pig iron is an important competitive factor and the cost of pig iron depends mainly upon the prices of ore and coke. These raw materials, particularly the latter, are cheaper in the United States than in most European countries. Pipe works which are generally located on rivers or on the seacoast and buy their pig iron, find it advantageous to have pig iron on the free list. Labor cost is important in the production of certain high-grade iron castings, and wages are lower than in the United States. Unfortunately there is little available data for the study of foreign wage conditions in relation to labor cost. In the manufacture of high-grade castings, the labor cost has not thus far worked to the disadvantage of the American producer.

In some lines steel castings, as has already been shown, are taking the place of iron castings. With the utilization of hydroelectric power in France and other countries this change may result in competition between foreign steel castings and American iron castings. In the manufacture of most steel articles the American cost of production is the lowest in the world. Steel castings, however, can be very cheaply made by utilizing hydroelectric power, and it is stated that these articles may ultimately be imported into the United States at low cost.

TARIFF CONSIDERATIONS.

As already shown, the American manufacturer of iron castings is not seriously threatened by foreign competition. It has been urged that in the case of certain high-grade castings a classification should be made which will permit the imposition of higher duties on such articles as are produced at a high labor cost. It has been stated that over half the cost of producing some of these high-grade castings is labor cost. The statement is probably exaggerated, but the labor item is certainly important in the total expense of manufacture.

Ad valorem duties are well suited to cast-iron products by reason of the great variety of products and values. Of these castings, cast-iron pipe alone is really standardized.

[8] The Times (London), November, 1920.

Production in United States, by States.

PIG IRON—DIRECT CASTINGS.[1]

[From Federal Census.]

State.	1919	1914	1909	1904	1899
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Alabama	962	2,860	2,588	332	3,464
Illinois	442	274	.....	680	0
Michigan	.....	24	.....	.....	.....
Ohio	7,340	3,898	338	5,129	.....
Pennsylvania	5,938	4,613	4,563	2,941	4,339
Tennessee	.....	2,074	49	18	.....
New York	585	.....	440	310	.....
Virginia	.....	.....	129	.....	297
Georgia	.....	.....	.....	59	.....
New Jersey	297	.....	.....	.....	35
All other	2,132	641	8,074	.....	10
Total	17,696	14,384	16,181	9,469	7,125

[1] Castings made direct from blast furnace.

CAST-IRON PIPE AND FITTINGS AND ALL OTHER CASTINGS.[1]

[From Federal Census, 1914.]

State.	1919		1914	
	Quantity.	Value.	Quantity.	Value.
	Net tons.		*Net tons.*	
Alabama	3,395	$310,887	267,292	$6,747,540
New Jersey	5,779	480,247	265,443	6,406,279
New York	[2]	[2]	11,862	376,680
Ohio	4,684	487,293	155,061	3,229,619
Pennsylvania	[2]	[2]	209,701	4,550,718
All other	2,543	336,038	170,225	3,918,960
Total	16,401	1,614,465	1,079,584	25,217,687

[1] Figures in this table include the total output of all establishments engaged primarily in the production of cast-iron pipe and fittings.
[2] Included in all other.

CAST-IRON PIPE AND FITTINGS.

[From Federal Census.]

State.	1919		1914	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
Alabama	272,588	$18,232,060	264,411	$9,620,125
New Jersey	115,237	8,340,065	263,915	6,238,367
New York	20,157	1,773,330	11,772	365,300
Ohio	81,114	5,240,015	152,944	3,109,648
Pennsylvania	115,896	8,783,542	208,604	4,479,442
All other	97,562	6,145,569	164,357	3,621,087
Total	702,554	48,514,581	1,066,003	28,533,970

Production in United States.

CAST-IRON PIPE AND FITTINGS.

[From American Iron and Steel Institute.]

Years.	Gas and water.		Soil and plumbers'.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Net tons.		*Net tons.*		*Net tons.*	
1913	1,010,016		256,229		1,266,245	
1914	938,297		222,483		1,160,780	
1915	956,372		258,498		1,214,870	
1916	934,626		279,707		1,214,333	
1917	748,173		250,928		999,101	
1918	508,300		111,373		619,673	
1919	514,664		195,417		710,081	
1920	636,862		249,653		886,515	

Cast-iron pipe—Production in principal foreign countries.

Years.	Canada.[1]		Years.	Canada.[1]	
	Quantity.	Value.		Quantity.	Value.
	Net tons.			*Net tons.*	
1913	96,800		1917	26,970	
1914	93,200		1918	20,150	
1915	53,700		1919	37,530	
1916	43,850		1920	59,850	

[1] From Annual Statistical Report of the American Iron and Steel Institute.

Imports for consumption—Revenue.

CASTINGS—CAST-IRON PIPE OF EVERY DESCRIPTION.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ cent per pound	1,888,594	$23,775.50	$7,554.37	$0.013	31.77
1908	do	8,074,240	90,022.00	32,296.96	.011	35.87
1909	do	168,690	2,512.00	674.76	.015	26.86
1910[2]	do	35,480	500.00	141.92	.014	28.38
1910[3]	$\frac{1}{4}$ cent per pound	170,234	2,638.00	425.59	.015	16.13
1911	do	213,121	3,269.60	532.81	.015	16.30
1912	do	260,125	3,690.05	650.31	.014	17.62
1913	do	263,614	4,445.00	659.04	.017	14.82
1914[3]	do	19,617	387.00	49.04	.020	12.67
1914[4]	10 per cent	155,007	3,006.30	300.63	.019	10.00
1915	do	179,498	3,715.00	371.50	.021	10.00
1916	do	270,947	4,984.00	498.40	.018	10.00
1917	do	190,004	4,245.00	424.50	.022	10.00
1918	do	342,436	6,920.00	692.00	.020	10.00
1918[5]	do	269,364	5,074.00	507.40	.019	10.00
1919[5]	do	164,945	6,226.00	622.60	.038	10.00
1920[5]	do	670,224	41,074.00	4,107.40	.061	10.00
1921[6]	do	29,488	2,146.00	214.60	.073	10.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] Calendar years.

Imports for consumption—Revenue—Continued.

CAST-IRON PLATES, STOVE PLATES, AND IRONS, SADIRONS, TAILORS' IRONS, HATTERS' IRONS, AND CASTINGS AND VESSELS WHOLLY OF CAST IRON—UNDER GENERAL TARIFF.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	$\frac{1}{10}$ cent per pound.	1,614,971.00	$118,688.56	$12,919.79	$0.073	10.8
1908	....do	1,396,376.50	93,371.28	11,171.01	.067	11.9
1909	....do	2,304,999.75	170,272.38	18,440.00	.074	10.8
1910	....do	3,223,598.50	237,185.40	25,788.77	.073	10.8
1911	....do	1,564,499.75	112,126.70	12,515.97	.072	11.1
1911 [6]	$\frac{1}{10}$ cent per pound less 20 per cent.	840.00	63.00	5.38	.075	8.5
1912	$\frac{1}{10}$ cent per pound.	1,118,330.25	77,463.07	8,946.60	.069	11.5
1913	....do	1,240,345.88	40,622.72	9,922.77	.033	24.4
1913	D. R., sec. 19	9,843.00	709.00		.072	
1914 [3]	....do	138,927.00	4,421.00	1,111.41	.032	25.1
1914 [4]	10 per cent	548,919.00	23,674.90	2,367.49	.043	10.0
1915	....do	358,107.00	15,367.00	1,536.70	.043	10.0
1916	....do	380,299.00	16,141.00	1,614.10	.042	10.0
1916 [6]	10 per cent less 20 per cent.	20.00	2.00	.16	.100	8.0
1917	10 per cent	2,022,331.00	76,853.00	7,685.30	.038	10.0
1918	....do	1,874,731.00	96,028.00	9,602.80	.051	10.0
1918 [7]	Free, Sec. IV, J5	18,467.00	1,010.00		.055	
Calendar years:						
1918	10 per cent	1,631,225.00	103,309.00	10,330.90	.063	10.0
1918 [7]	Free, Sec. IV, J5	130,080.00	16,088.00		.124	
1919	10 per cent	1,559,012.00	147,607.00	14,760.70	.095	10.0
1919 [7]	Free, Sec. IV, J5	106,250.00	18,009.00		.169	
1920	10 per cent	2,383,842.00	225,863.00	22,586.30	.095	10.0
1920 [7]	Free, Sec. IV, J5	2,720.00	1,453.00		.534	
1921	10 per cent	830,984.00	70,197.00	7,019.70	.084	10.0

MALLEABLE IRON CASTINGS, N. S. P. F.

1907	$\frac{1}{10}$ cent per pound.	864,898.44	$45,085.86	$7,784.08	$0.052	17.27
1908	....do	810,305.00	41,544.00	7,292.79	.051	17.55
1909	....do	804,216.00	42,646.00	7,237.96	.053	16.97
1910 [1]	....do	60,610.00	3,006.00	545.48	.049	18.14
1910 [2]	$\frac{1}{10}$ cent per pound.	1,057,897.00	54,756.00	7,403.22	.052	13.52
1911	....do	1,016,689.50	51,570.00	7,116.87	.051	13.80
1912	....do	1,071,015.00	55,198.70	7,497.12	.052	13.58
1913	....do	1,873,047.00	78,878.00	13,111.35	.042	16.62
1914 [3]	....do	281,986.00	15,423.00	1,973.91	.055	12.80
1914 [4]	10 per cent	1,220,436.00	49,981.00	4,998.10	.041	10.00
1915	....do	770,453.00	41,719.00	4,171.90	.054	10.00
1916	....do	981,882.00	43,579.00	4,357.90	.044	10.00
1917	....do	2,903,585.00	125,007.00	12,500.70	.043	10.00
1918	....do	820,657.00	56,162.00	5,616.20	.068	10.00
1918 [5]	....do	681,423.00	71,235.00	7,123.50	.105	10.00
1918 [5] [7]	Free Sec. IV, J5	3,544.00	807.00		.245	
1919 [5]	10 per cent	1,319,233.00	107,163.00	10,716.30	.081	10.00
1920 [5]	....do	6,696,068.00	658,331.00	65,833.10	.098	10.00
1921 [5]	....do	1,892,757.00	189,086.00	18,908.60	.100	10.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] Calendar years.
[6] Reciprocity treaty with Cuba.
[7] For the construction and equipment of vessels.

Imports for consumption—Revenue—Continued.

GS OF IRON OR CAST-IRON PLATES, CHISELED, DRILLED, MACHINED, OR RWISE ADVANCED IN CONDITION BY PROCESS OR OPERATIONS SUBSE- T TO THE CASTING PROCESS, BUT NOT MADE UP INTO ARTICLES OR FINISHED INE PARTS.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1 cent per pound..	274,357	$7,880.00	$2,743.57	$0.029	34.82
.....	.....do.....	1,710,023	65,361.00	17,100.33	.038	26.16
.....	.....do.....	879,999	31,089.00	8,799.99	.035	28.31
.....	.....do.....	1,019,623	34,158.75	10,196.23	.034	29.85
.....	D. R. Pan act.....	24,725	1,080.00	.....	.044	.....
.....	1 cent per pound..	101,120	5,160.00	1,011.20	.051	19.60
.....	10 per cent.....	103,875	7,509.26	750.93	.072	10.00
.....	.....do.....	103,047	4,397.00	439.70	.043	10.00
.....	.....do.....	113,314	5,287.00	528.70	.047	10.00
.....	10 per cent less 20 per cent.	47	5.00	.40	.106	8.00
.....	Free, Sec. IV, J5..	53,045	1,933.00	.....	.036	.....
.....	10 per cent.....	86,352	3,627.00	362.70	.042	10.00
.....	.....do.....	265,869	18,394.00	1,839.40	.069	10.00
.....	Free, Sec. IV, J5..	15,680	2,500.00	.....	.159	.....
years:						
.....	10 per cent.....	381,592	24,884.00	2,488.40	.065	10.00
.....	Free, Sec. IV, J5..	41,290	5,864.00	.....	.142	.....
.....	10 per cent.....	47,247	4,307.00	430.70	.091	10.00
.....	.....do.....	129,181	13,147.00	1,314.70	.102	10.00
.....	.....do.....	36,391	3,595.00	359.50	.099	10.00

, 1909, to June 30, 1910, under act of 1909.
to Oct. 3, 1913, under act of 1909.
, 1913, to June 30, 1914, under act of 1913.
rocity treaty with Cuba.
e construction and equipment of vessels.

Domestic exports.

RADIATORS AND CAST-IRON HOUSE-HEATING BOILERS.[1]

[Fiscal years.]

Country.	1911		1912		1913	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
.....	82,270	$2,052	26,927	$778	27,551	$643
.....	7,920	198	2,799	90	.....	.....
.....	23,670	612	.....	.....	.....	.....
.....	56,466	1,690	69,897	2,217	.....	.....
.....	800	20	36,540	1,242	.....	.....
Europe.....	.....	.....	.....	.....	25,095	620
ingdom.....	498,209	16,839	211,730	8,031	117,924	7,669
.....	6,181,261	201,989	7,639,921	250,552	17,979,013	653,182
.....	160,485	5,477	48,901	1,606	236,644	9,904
dland and Labrador.....	41,016	1,170	145,319	4,889	7,166	344
.....	64,698	1,535	26,553	657	12,681	495
.....	72,135	2,066	74,750	2,157	22,300	900
.....	17,812	421	371,325	14,012	72,032	2,738
.....	892,883	21,341	539,135	13,079	677,381	20,719
and.....	17,922	538	.....	.....	17,607	675
outh Africa.....	5,160	129	1,300	45	16,151	345
.....	462,984	12,577	242,662	7,530	86,197	2,647
al.....	8,585,691	268,654	9,437,759	306,885	19,297,742	700,881

ed in "all other manufactures of" prior to 1911.

Domestic exports—Continued.

RADIATORS AND CAST-IRON HOUSE-HEATING BOILERS—Continued.

Country.	1914		1915		1916	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Belgium						
Denmark			15,792	$473	45,733	$1,725
France					337,715	13,114
Germany	16,684	$490				
Norway			1,750	60		
Russia in Europe			49,000	1,625		
United Kingdom	258,000	11,831	146,328	7,641	1,046,446	34,629
Canada	11,445,337	401,980	5,230,502	180,640	2,813,120	128,772
Mexico	10,690	417	6,250	294	80	4
Newfoundland and Labrador	5,653	145	75,533	2,246	40,960	1,173
Argentina			14,625	361	470	20
China	72,268	2,945	45,432	1,520	168,653	6,158
Chosen			34,060	1,199	166,032	8,000
Japan	433,460	11,755	294,791	7,957	192,706	6,909
New Zealand					13,400	983
British South Africa	336	8			28,464	862
All other	4,513	149	63,836	2,829	439,367	14,911
Total	12,246,941	429,720	5,978,199	206,845	5,283,144	201,771

Country.	1917		1918	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Belgium				
Denmark	350,818	$13,171		
France	2,018,014	71,247	199,690	$8,467
Germany				
Norway	1,189,724	55,876	444,400	17,901
Russia in Europe	139,689	4,779		
United Kingdom	276,459	10,623	48,643	2,122
Canada	2,790,874	163,201	2,255,300	165,644
Mexico	1,811	142	3,743	407
Newfoundland and Labrador	34,360	1,682	39,534	2,049
Argentina	43,045	2,672	101,423	6,539
China	864,407	55,370	1,184,504	65,039
Chosen	31,765	1,650	2,201	139
Japan	1,907,779	104,882	1,486,583	120,457
New Zealand			1,630	208
British South Africa				
All other	1,072,406	52,884	598,808	42,086
Total	10,721,151	538,179	6,366,749	451,673

RADIATORS AND HOUSE-HEATING BOILERS.

[Calendar years.]

Country.	1918		1919		1920		1921	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
Belgium			239	$27	150	$36		
Denmark	23,468	$1,173	7,444	697	485	126	350	$41
France	23,500	845	2,726,480	156,116	3,192,689	192,704	31,703	2,943
Germany								
Norway	406,671	46,035	190,757	18,386	65,710	4,941	550	69
Russia in Europe								
United Kingdom	63,665	4,264	563,169	34,524	690,100	39,828	284,238	29,291
Canada	1,975,560	153,784	2,692,704	238,870	3,718,232	417,948	2,309,621	220,537
Mexico	16,269	2,180	87,845	7,625	679,702	59,665	71,414	10,479
Newfoundland and Labrador	58,417	3,963	82,409	8,070	203,327	20,502	216,776	16,201
Argentina	70,722	4,913	146,872	10,948	377,300	29,208	88,313	6,165
China	1,108,222	85,359	1,345,564	106,704	2,648,959	209,197	1,449,222	93,559
Chosen			45,724	4,483	16,710	1,857	37,449	4,234
Japan	1,765,896	164,873	1,858,912	135,866	3,572,617	203,118	2,409,710	144,582
New Zealand	1,630	200	15,974	1,823	25,253	4,644	10,263	1,551
British South Africa	2,788	304	24,303	2,983	10,178	1,597		
All other	792,905	80,907	641,608	52,140	1,230,765	131,661	474,386	46,368
Total	6,399,793	548,800	10,430,464	779,259	16,432,177	1,337,032	7,634,186	575,427

Domestic exports—Continued.

STOVES, RANGES, AND PARTS OF.

[Fiscal years.]

Country.	1910	1911	1912	1913	1914
France	$3,812	$3,924	$3,316	$2,468	$5,419
Germany	14,433	9,951	10,999	7,511	8,338
Italy	13,388	16,559	9,395	9,275	8,299
Netherlands	11,933	9,548	9,174	16,045	14,907
United Kingdom	37,018	48,391	54,674	61,590	93,422
Canada	635,900	832,447	1,041,935	1,314,725	975,460
Panama	23,595	17,819	24,609	30,476	32,814
Mexico	94,770	109,359	121,948	106,259	47,568
Cuba	13,921	12,773	12,363	10,909	18,980
Argentina	81,631	86,568	115,380	95,652	52,165
Brazil	19,339	21,437	23,190	54,572	80,533
Chile	24,805	23,689	24,446	23,093	23,072
China	12,440	19,740	19,152	13,486	25,571
Japan	18,868	17,275	8,175	11,295	4,549
Australia	34,074	60,590	53,709	80,124	57,743
New Zealand	11,529	20,182	15,628	20,317	22,035
Philippine Islands	16,862	23,975	22,602	29,547	21,805
British South Africa	68,347	105,843	110,897	89,359	94,112
All other	158,132	136,317	181,140	169,489	221,404
Total	1,294,797	1,582,387	1,862,732	2,146,192	1,808,196

Country.	1915	1916	1917	1918
France	$290,274	$36,837	$14,050	$25,914
Germany	270	.....	.....	.....
Italy	8,035	11,031	16,290	27,665
Netherlands	3,802	14,356	3,272	.....
United Kingdom	243,558	276,514	377,164	26,503
Canada	450,837	413,067	680,132	684,442
Panama	36,985	46,708	58,279	64,671
Mexico	19,968	38,316	72,633	114,927
Cuba	36,341	89,840	146,185	179,680
Argentina	27,621	61,245	104,771	40,577
Brazil	130,192	86,968	73,914	127,926
Chile	10,318	39,083	89,581	130,553
China	28,352	19,720	11,841	34,396
Japan	6,277	8,929	20,687	109,029
Australia	55,319	65,754	39,794	30,223
New Zealand	17,350	15,323	9,326	2,974
Philippine Islands	28,729	11,848	16,066	24,108
British South Africa	62,739	98,899	69,623	87,460
All other	167,866	182,747	1,043,003	212,731
Total	1,624,833	1,517,185	2,866,611	1,923,779

STOVES AND RANGES.

[Calendar years.]

Country.	1918	1919	1920	1921
France	$43,179	$59,864	$71,304	$8,146
Germany	.....	15	6,830	641
Italy	15,526	25,241	50,695	17,670
Netherlands	.....	51,775	57,244	38,748
United Kingdom	27,292	491,946	2,784,254	844,210
Canada	669,465	682,767	640,371	326,700
Panama	37,275	32,289	51,081	26,518
Mexico	88,362	182,695	302,429	350,096
Cuba	193,603	176,945	405,265	238,570
Argentina	30,746	70,661	91,828	102,030
Brazil	37,158	49,214	68,800	33,197
Chile	100,534	74,392	78,660	41,727
China	46,277	64,660	138,896	102,081
Japan	83,327	112,890	119,166	114,686
Australia	20,405	18,177	28,067	33,531
New Zealand	2,405	8,559	39,570	26,450
Philippine Islands	36,988	44,626	90,141	47,029
British South Africa	62,505	79,054	173,771	72,481
All other	208,676	383,945	718,929	403,537
Total	1,703,724	2,609,715	5,937,301	$2,828,048

Domestic exports—Continued.

PIPES AND FITTINGS—CAST.[1]

[Fiscal years.]

Country.	1915		1916	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Denmark	177,143	$3,145	6,709	$126
France	631,511	14,214	1,931,840	43,607
Italy	1,880,475	38,784	2,565,485	62,929
Norway	4,990	90	121,953	2,737
United Kingdom	4,265,768	82,051	7,176,834	162,989
Canada	23,558,279	532,690	9,560,498	208,972
Panama	26,610,719	340,931	4,771,141	104,334
Mexico	1,834,808	63,304	5,472,837	153,634
Newfoundland and Labrador	476,446	9,432	3,269,983	54,323
Cuba	31,918,111	392,298	28,592,027	602,186
Argentina	730,436	19,489	4,992,265	139,969
Brazil	1,422,603	25,918	1,371,030	35,057
Chile	857,104	16,624	2,472,573	61,321
China	272,572	8,057	1,350,413	42,532
British India	2,728,380	47,196	1,601,649	33,737
Japan	6,977,747	158,016	14,282,359	336,693
Australia	2,931,632	52,912	2,759,096	69,987
Philippine Islands	3,419,409	47,622	3,426,297	94,423
British South Africa	200,547	3,911	2,381,790	60,919
All other	28,854,972	580,551	19,738,516	449,999
Total	139,753,742	2,437,235	117,844,295	2,784,282

Country.	1917		1918	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
Denmark	1,897,974	$47,674		
France	2,959,516	153,602	1,629,086	$115,983
Italy	2,219,535	77,698	2,289,980	143,971
Norway	1,499,563	102,248	447,606	15,397
United Kingdom	5,780,722	206,606	2,822,657	162,721
Canada	12,778,653	517,521	10,726,900	836,478
Panama	10,728,343	260,400	1,232,147	56,624
Mexico	11,581,089	412,043	24,305,066	1,315,200
Newfoundland and Labrador	789,285	22,359	338,860	18,532
Cuba	41,241,306	1,080,761	29,911,669	1,498,229
Argentina	3,233,478	126,535	11,767,994	412,431
Brazil	2,521,228	76,269	3,534,182	198,262
Chile	6,382,199	204,918	15,969,536	765,164
China	611,905	21,582	1,777,900	104,283
British India	1,938,685	79,784	4,838,947	208,257
Japan	7,100,190	219,211	24,905,861	1,141,957
Australia	2,864,037	88,877	1,783,625	142,529
Philippine Islands	304,233	20,642	2,131,955	119,904
British South Africa	2,507,507	92,234	3,840,701	156,697
All other	49,880,499	1,243,767	31,941,725	1,346,954
Total	169,019,947	5,054,731	176,195,457	9,033,738

[1] Included in "Pipes and fittings" prior to 1915.

Domestic exports—Continued.

PIPES AND FITTINGS—CAST—Continued.

[Calendar years.]

ıntry.	1918		1919		1920		1921	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
.....	.....	.....	591,853	$24,832	.....	.....	3,162	$860
.....	1,160,775	$86,472	1,697,314	115,781	627,995	$54,997	525,684	41,698
.....	625,186	40,236	339,821	24,581	.....	.....	40,592	7,689
.....	478,041	17,056	336,327	18,294	.....	.....	43,635	6,855
ingdom.....	808,327	71,461	3,374,909	261,766	5,037,270	468,172	2,316,686	215,720
.....	9,892,668	773,770	9,240,505	763,440	10,468,480	1,003,172	9,250,425	559,029
.....	591,781	47,890	2,385,890	91,980	843,370	56,708	340,106	25,185
.....	14,559,978	854,788	14,201,131	892,099	30,215,386	2,171,350	37,832,684	2,725,899
land and or.....	130,776	11,032	296,924	19,851	.....	.....	486,085	27,959
.....	19,110,866	1,075,115	23,109,905	975,981	50,553,484	2,657,810	18,878,130	1,001,735
.....	1,613,197	135,961	3,367,235	165,849	3,379,612	233,610	1,283,107	128,423
.....	5,554,410	278,067	3,400,144	192,054	6,058,077	325,797	891,290	71,292
.....	8,241,943	508,258	2,104,427	133,592	1,007,531	71,347	722,064	68,922
.....	1,406,841	79,588	907,382	79,641	1,634,589	146,621	1,313,317	111,558
dia.....	2,937,380	192,350	980,310	67,467	3,148,417	202,421	4,985,978	309,098
.....	24,075,465	941,683	2,715,786	166,685	14,157,446	550,589	6,277,141	394,285
.....	2,339,076	174,495	1,231,364	105,167	542,574	49,402	1,739,409	172,107
e Islands....	1,437,260	82,024	1,884,533	119,121	3,058,963	294,689	1,053,922	71,350
uth Africa..	1,245,867	74,459	145,574	11,033	.....	.....	160,572	26,458
.....	29,142,229	1,220,892	16,068,370	948,538	22,521,033	1,466,761	20,549,918	1,299,625
al.....	125,352,066	6,665,597	88,379,704	5,177,752	153,254,227	9,753,446	108,693,907	7,265,747

Cast-iron pipe—Prices at New York, 6-inch, per net ton.

[From the Iron Age.]

Month.	1900	1901	1902	1903	1904	1905	1906
.....	$27.50	$21.75	$24.50	$29.25	$24.50	$28.00	$29.75
.....	26.75	22.25	25.00	29.25	24.25	28.50	29.50
.....	26.75	21.50	26.25	30.75	24.25	26.75	30.50
.....	26.50	22.00	26.00	31.00	24.25	27.00	29.75
.....	26.00	22.25	27.75	30.75	24.00	27.25	31.00
.....	24.50	23.00	28.00	30.75	23.50	27.25	32.50
.....	24.75	23.75	28.50	30.75	23.50	27.25	30.25
.....	23.50	23.75	29.50	29.50	23.50	27.75	30.50
r.....	22.25	23.50	29.50	29.00	23.00	27.25	31.00
.....	21.75	24.00	29.50	26.00	23.25	28.25	33.00
.....	21.75	24.50	30.75	24.50	25.00	29.00	33.25
.....	21.75	23.75	29.25	24.25	27.00	29.25	35.50
rage.....	24.48	24.67	27.88	28.81	24.17	27.79	31.38
onthly average.....	27.50	24.50	30.75	31.00	27.00	29.25	35.50
onthly average.....	21.75	21.50	24.50	24.25	23.00	26.75	29.50

Month.	1907	1908	1909	1910	1911	1912	1913
.....	$34.25	$27.00	$24.50	$25.50	$22.00	$22.00	$25.00
.....	34.25	26.75	24.25	25.50	21.50	22.00	24.75
.....	34.00	26.25	25.25	25.50	21.00	22.00	23.87
.....	33.50	26.25	25.00	25.50	21.00	21.25	23.50
.....	34.25	26.25	25.25	25.50	21.00	21.00	23.00
.....	33.50	25.75	26.00	25.25	21.00	21.00	23.00
.....	34.00	25.75	26.25	24.00	21.00	22.10	23.00
.....	32.50	25.25	26.00	23.50	21.00	22.00	23.00
r.....	33.00	25.75	25.75	23.50	21.00	23.12	23.00
.....	33.50	25.75	25.50	23.00	21.00	24.50	23.00
.....	28.50	25.00	25.87	22.12	21.40	24.12	23.00
.....	28.00	25.50	25.70	22.00	22.00	24.62	22.33
rage.....	31.94	25.94	25.44	24.24	22.48	22.48	23.37
onthly average.....	34.25	27.00	26.25	25.50	22.00	24.62	25.00
onthly average.....	28.00	25.00	24.25	22.00	21.00	21.00	22.33

Cast-iron pipe—Prices at New York, 6-inch, per net ton—Continued.

Month.	1914	1915	1916	1917	1918	1919	1920
January	$22.00	$20.00	$29.00	$41.50	$55.35	$65.70	$80.30
February	22.00	20.00	29.33	41.50	55.25	62.70	70.30
March	22.00	20.00	29.75	43.10	55.35	62.70	71.30
April	22.00	21.60	30.50	50.88	55.35	57.70	73.90
May	20.88	22.00	30.50	55.50	56.60	54.45	70.30
June	20.50	22.25	30.50	60.75	61.44	52.05	70.30
July	20.50	22.50	30.50	65.50	61.75	50.46	70.30
August	20.50	23.25	30.50	65.50	61.75	52.33	70.22
September	20.40	24.37	30.83	65.50	61.75	54.30	71.22
October	20.00	25.25	31.50	61.00	67.70	55.30	71.22
November	20.00	26.50	35.50	56.50	67.70	58.30	71.22
December	20.00	27.60	41.00	56.50	67.70	61.30	68.67
Average	20.90	22.94	31.62	55.31	60.65	57.27	70.98
Highest monthly average	22.00	27.60	41.00	65.50	67.70	65.70	71.22
Lowest monthly average	20.00	20.00	29.00	41.50	55.35	50.46	68.30

Cast iron—Rates of duty.[1]

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883....	156	Cast-iron pipe of every description	1 cent per pound.
	157	Cast-iron vessels, plates, stove plates, andirons, sadirons, tailors' irons, hatters' irons, and castings of iron, not specially enumerated or provided for in this act.	1¼ cents per pound.
	161	Malleable-iron castings, not specially enumerated or provided for in this act.	2 cents per pound.
1890....	160	Cast-iron pipe of every description	$\frac{1}{5}$ of 1 cent per pound.
	161	Cast-iron vessels, plates, stove plates, andirons, sadirons, tailors' irons, hatters' irons, and castings of iron, not specially provided for in this act.	$1\frac{1}{5}$ cents per pound.
	162	Castings of malleable iron not specially provided for in this act..	1¼ cents per pound.
1894....	133	Cast-iron pipe of every description	$\frac{1}{5}$ of 1 cent per pound.
	134	Cast-iron vessels, plates, stove plates, andirons, sadirons, tailors' irons, hatters' irons, and castings of iron, not specially provided for in this act.	$\frac{1}{5}$ of 1 cent per pound.
	135	Castings of malleable iron not specially provided for in this act....	$\frac{1}{5}$ of 1 cent per pound.
1897....	147	Cast-iron pipe of every description	$\frac{1}{5}$ of 1 cent per pound.
	148	Cast-iron vessels, plates, stove plates, andirons, sadirons, tailors' irons, hatters' irons, and castings of iron, not specially provided for in this act.	$\frac{1}{5}$ of 1 cent per pound.
	149	Castings of malleable iron not specially provided for in this act....	$\frac{1}{5}$ of 1 cent per pound.
1909....	146	Cast-iron pipe of every description	$\frac{1}{4}$ of 1 cent per pound.
	147	Cast-iron andirons, plates, stove plates, sadirons, tailors' irons, hatters' irons, and castings and vessels wholly of cast iron. All castings of iron or cast-iron plates which have been chiseled drilled, machined, or otherwise advanced in condition by processes or operations subsequent to the casting process but not made up into articles, shall pay two-tenths of 1 cent per pound more than the rate imposed upon the castings of iron and cast-iron plates hereinbefore provided for.	$\frac{1}{5}$ of 1 cent per pound.
	148	Castings of malleable iron not specially provided for in this section.	$\frac{1}{5}$ of 1 cent per pound.
1913....	125	Cast-iron pipe of every description, cast-iron andirons, plates, stove plates, sadirons, tailors' irons, hatters' irons, and castings and vessels wholly of cast iron, including all castings of iron or cast-iron plates which have been chiseled, drilled, machined, or otherwise advanced in condition by processes or operations subsequent to the casting process but not made up into articles or finished machine parts; castings of malleable iron not specially provided for in this section.	10 per cent ad valorem.

[1] See also rates of duty, page 77.

Court and Treasury Decisions.

The phrase "not made up into articles" has been interpreted to mean *castings finished* and ready for ultimate use, and not castings which are mere materials finished and ready for manufacturing purposes, and the phrase "finished machine parts" refers to castings destined to become parts of machines. A brewery-mash filter was

held not to be a machine for the purposes of paragraph 125. Cast-iron frames, plates, centerpieces, heads or ends and posts for the same use, were held to be castings of iron "not made up into articles or finished machine parts." (*Simon* v. *United States*, 8 Ct. Cust. Appls., 273, of 1918; see also *United States* v. *Leigh*, 4 Ct. Cust. Appls., 304, of 1913.) So were cast-iron parts of boilers (G. A. 8094, T. D. 37354, of 1917.) And *finished castings*, molded, drilled, and machined, and requiring, to make the machine complete, rubber gaskets, filter cloths, bronze and copper work, were held to be "not made up into articles." (*Lang* v. *United States*, 5 Ct. Cust. Appls., 362, of 1914.) *Fireplace* and *mantel sets* (*Jackson* v. *United States*; 2 Ct. Cust. Appls., 475, of 1912); *date nails* of cast iron, malleable, and galvanized or plated with zinc (G. A. 7363, T. D. 32506, of 1912); so-called *cores of cast iron*, steel plates and a ring for the manufacture of automobile tires (G. A. 8253, T. D. 37989, of 1919); and a *finished propeller* (Abstract 42243, of 1918) were held dutiable as manufactures of metal. *Cast-iron bowls* and *cylindrical cast-iron kettles* with flanges and rims, classified as hollow ware of iron, have been held dutiable as cast hollow ware glazed. (*Sittig* v. *United States*, 4 Ct. Cust. Appls., 281, of 1913.)

The omission of the provision in paragraph 125 and that in paragraph 134 for hollow ware would bring within paragraph 134 all flat ware of the description therein provided for and relegate to paragraph 167 all other hollow ware wholly or in chief value of metal.

NUTS, WASHERS, BOLTS, HINGES, SPIRAL NUT LOCKS, AND LOCK WASHERS.

Summary.

The total value of bolts, nuts, washers, and rivets produced in 1914 in the various classes of establishments reporting the manufacture of these articles to the census was $34,147,465. Pennsylvania and Ohio were the leading States. Other important producing States were New York, Massachusetts, Indiana, Illinois, and Connecticut, each with a production valued in excess of $1,000,000.

Exports in 1913 amounted to 48,458,712 pounds, valued at $1,700,205, and in 1921, to 54,276,882 pounds, valued at $4,884,596. In 1913 more bolts, nuts, rivets, and washers were exported to England than to any other country.

Imports have been small. In 1914 nuts, washers, bolts, hinges, spiral nut locks, and lock washers to the value of $36,927 were imported. In 1921, the imports were valued at $53,356.

The leading foreign producers before the war were Germany, England, France, and Sweden.

American producers hold a very strong position in international trade competition derived from their control of the greatest domestic market in the world, the extensive use of labor saving machinery, the comparatively low price of iron and steel in the United States.

Nuts, washers, bolts, hinges, spiral nut locks, and lock washers—Summary table.

Year.	Domestic production.	Imports for consumption.	Domestic exports.[1]	Value (imports for consumption).	Amount of duty.	Value per pound.	Equivalent ad valorem rate.
Fiscal years:		*Pounds.*	*Pounds.*				*Per cent.*
1910		248,599		$20,902.14	$2,623.93	$0.084	12.55
1911		529,445		29,205.23	5,565.24	.059	20.06
1912		310,781		26,323.29	3,083.22	.083	11.71
1913		548,031	48,458,712	34,724.00	5,723.27	.063	16.48
1914	[2] $34,147,465	622,748	44,413,047	36,927.05	4,659.41	.059	12.62
1915		752,946	30,240,419	28,031.00	2,170.60	.037	7.74
1916		446,691	69,030,195	28,436.00	2,369.25	.063	8.33
1917		387,875	66,151,801	26,634.00	2,209.65	.059	8.30
1918		256,337	67,551,383	21,601.00	1,756.00	.084	8.13
Calendar years:							
1918		146,844	63,465,111	19,783.00	1,406.00	.135	7.11
1919		213,468	89,023,056	32,068.00	2,511.03	.153	7.80
1920		698,934	87,235,028	71,123.00	6,634.00	.102	9.32
1921		619,918	54,276,882	53,356.00	4,882.65	.085	9.15

[1] Including bolts, nuts, rivets, and washers of iron or steel. Exports were not specified prior to 1913.
[2] Percentages calculated on values.
[3] See "General information," paragraph on "organization."

General Information.

TARIFF PARAGRAPH, 1913.

123. Nuts or nut blanks and washers, 5 per centum ad valorem; bolts of iron or steel, with or without threads or nuts, or bolt blanks finished hinges or hinge blanks, 10 per centum ad valorem; spiral nut locks and lock washers, whether of iron or steel, 30 per centum ad valorem.

DESCRIPTION.

Bolts and nuts are usually of standard design, although lock nuts are made to special designs (usually on the principle of a rolling wedge or a simple pin fitted into a hole drilled in the nut, bolt, or both). Various designs of nut locks have been made; the standard type is an open spiral washer of spring steel, roughened or machined so as to engage the nut and prevent it from turning on the thread.

The classification of bolts, nuts, washers, and rivets in the Census of Manufactures of 1914 overlaps but does not coincide with the classification of articles in paragraph 123. The census statistics include carriage and trunk bolts; couplings; foundation and machine bolts; plow, stove, and tire bolts; expansion and toggle bolts; lock and axle nuts; bifurcated rivets and tubular nuts for boiler shops and structural purposes; lock washers and riveting and other burs; spring and other cotters; staples; gaskets; floor caps and similar articles.

DOMESTIC PRODUCTION.

Materials.—Nuts or nut blanks and bolts or bolt blanks are made of iron or steel bars. Hinges may be made of iron or steel plates or of cast iron. Washers are made of iron or steel plates, sometimes of scrap metal. Spiral nut locks are made of high-grade steel rods.

Equipment.—Complex and expensive machines are used in the production of bolts and nuts. (See Methods of production.)

Methods of production.—A. Bolts: Bolts are made by automatic, or semiautomatic, machines called headers or heading machines. The

ck of which bolts are made consists of round iron bars of the di-
eter of the bolt to be produced. Aside from threading, the process
manufacture comprises only two distinct operations, shearing to
gth and forming the head. The heading machines are of two
sses, stop-motion and continuous-motion. A bolt header is pro-
led with two gripping dies, one movable and the other stationary,
l a ram which carries the heading tool. In the stop-motion header
operator places the heated bar, sheared to length, between the
s of the machine and sets the machine in motion. The dies grip
bar, and the ram advances the heading tool, which strikes the end
the bar one or more blows to form the bolt head. The operator
y be required to turn the bar between blows of the heading tool
give its head the required shape. When the head has been formed
operator withdraws the finished bolt.

In making bolts on the continuous-motion header a bar is heated
a distance of approximately 4 feet and is then pushed into the
achine, which automatically shears the bar to length, forms the
ads, and ejects the finished bolts, one bolt being produced at each
volution of the flywheel of the header. Continuous-motion head-
s produce bolts at a much faster rate than stop-motion headers, but
eir range of work is limited. They are used only for heading car-
ge bolts, short lengths of hexagon and square-head machine bolts,
d rivets. One type of the continuous-motion header is provided
th an automatic roll feed. In the operation of this type of ma-
ine the operator with a pair of tongs grips the bar (which is heated
a furnace adjacent to his machine) when it has reached the proper
nperature, draws it out and places it between the feed rolls. The
ated bar is drawn in by the rolls, fed through the shearing die,
pped in the gripping dies, and headed. The finished bolts are
cted at the rate of 40 to 70 per minute.

B. Nuts: The plain type of heading machine used in making bolts
d rivets is used also for producing the ordinary square and hexagon
ts in sizes from 2 inches up. In making nuts by this process the
ameter of the round bar of iron used should not exceed the diameter
the thread in the finished nut. The process consists of forming a
ad the size of the nut desired on the end of the bar and then pierc-
the hole in this head by punching the bar back, the metal removed
form the hole in the nut remaining attached to the bar. Since
tle if any material is wasted this is a very successful method of pro-
cing nuts 2 inches and larger on a commercial basis.

By the most common method of forging nuts the blanks are cut or
eared by a machine from the end of a heated bar of rectangular
ck, after which the hole is punched in the blank. This method
tails considerable waste. Not only does the slug removed to form
e hole become scrap, but in the case of hexagon-shaped nuts the
angular pieces cut from the bar between blanks also become scrap.
order to avoid wasting such triangular pieces cut from the bar,
tempts have been made to use bars of stock having V-shaped
tches rolled into them. Another method that has been tried to
oid waste is one by which the V-shaped notches are formed in the
ctangular bar by means of indenting tools on the nut-forging ma-
ines, which compress the metal on each side of the bar. Both
e notched bar and the indenting method were given years of trial
the United States, England, and Germany, but neither proved

successful. The indenting method failed because of the great pressure required to compress the bar and the nut blank into the proper shape.

A nut-forging machine described in "Machinery" for September, 1918, invented by an Englishman named Hollings, and known as the Hollings Indenting Type of Nut-Forging Machine, is said to have overcome the difficulty met by the old type of machine. A special shaped bar, thicker at the edges than along the center line, is used with this machine, which permits the indenting dies to work to better advantage and to turn out well-formed nuts without the application of excessive pressure. It is asserted that experimental tests showed that 3,200 pounds of stock were required by the old method to produce 10,000 ¾-inch hexagonal nuts, while by the Hollings' method only 2,300 pounds of stock were required to produce the same number and size of nuts. The amount of scrap was reduced from 1,100 pounds to 200 pounds.

C. Spiral nut locks: High-grade steel in the form of bars is carefully annealed. The rods or bars are then coiled in the form of a spiral spring by means of special coiling machines. The coils then have their ends cut off and are next put through specially built power presses, equipped with specially designed feeding attachments. To obtain the requisite spring temper, the nut locks are first heated in furnaces under pyrometric control, hardened by quenching in oil, and after careful cleaning to remove all scale, treated in specially designed tempering furnaces. Skilled labor is required throughout the processes.

D. Washers and hinges: Washers are stamped out of metal sheets or plates. Hinges are either stamped or forged from iron or steel plates, or are cast.

Organization.—In 1914, 102 establishments engaged primarily in the production of bolts, nuts, washers, and rivets, reported to the census a product valued at $23,403,000. They had a capital of $35,602,000 and employed 10,658 wage earners. In addition, 28 rolling mills reported the production of bolts, nuts, rivets, washers, etc., to the value of $9,682,385. Similar products to the value of $1,062,080 were made by establishments engaged primarily in the manufacture of other products, principally screws, nails, spikes, and machine-shop products. The total value of these products reported to the census in 1914 was therefore $34,147,465. In 1919 the output of these articles by 24 rolling mills was valued at $19,589,295. No production statistics are available for hinges.

Bolts, nuts, washers, and hinges are produced by means of automatic or semiautomatic machines. Most efficient production is obtained when the work is done on a large scale. In many cases these various articles as well as other iron or steel products are made in the same establishment.

Geographical distribution.—The total value of the product of establishments engaged primarily in the production of bolts, nuts, washers, and rivets in 1914 was $23,403,000. Pennsylvania and Ohio were the leading States, their product having been valued at $6,562,000 and $4,651,000, respectively. Other important producing States were New York, Massachusetts, Indiana, Illinois, and Connecticut, each with a production valued in excess of $1,000,000.

History.—The bolt and nut industry in America started in a very small way in Marion, Conn., in 1818, when a blacksmith named

gg began the manufacture of bolts by the forging process, using imple machine called a heading block, which was operated by a t treadle. In 1839 Mr. Rugg and Martin Barnes built the first clusive bolt and nut fa tory in the country at Marion, Conn. e industry soon be ame an important one in the United States. early as 1869 the value of bolts, nuts, washers, and rivets of iron steel not made in steel works or rolling mills was $7,191,000.

Domestic production and consumption.—Domestic production exds consumption. As against domestic production of bolts, nuts, ets, and washers valued at $34,147,465 in 1914, and exports ued at $1,635,707, imports of nuts, washers, bolts, hinges, spiral locks, and lock washers were valued at only $36,927.

Domestic exports.—Exports of bolts, nuts, rivets, and washers e been specified in Commerce and Navigation since 1913, in ch year they amounted to 48,458,712 pounds, valued at $1,700,205. 1914 exports were somewhat smaller both in quantity and value, in 1915 they amounted to only 30,240,419 pounds, valued at 06,470. In 1916 exports increased sharply, amounting to 90,195 pounds, valued at $2,578,386. In both 1917 and 1918 quantity exported was somewhat less than in 1916, but the ue rose in 1917 to $4,044,546 and in 1918 to $5,544,920. In 1921 e were 54,276,882 pounds exported, valued at $4,884,596.

he leading countries of destination in 1913 were, in order of ue exported, England, Mexico, Canada, Cuba, Argentina, and ama. In 1921 the leading countries were Mexico, Argentina, Cuba, tralia, and Canada. Although most of the exports have gone ountries not highly developed industrially, like Mexico, Cuba, and entina, it should be noted that England ranked first.

FOREIGN PRODUCTION.

nited Kingdom.[9]—Production of bolts and nuts in the United gdom is insufficient to supply the domestic demand. Conrable quantities are imported from the United States. As in the ted States, bolts and nuts are made by automatic machinery and main item of cost is the raw material, which costs more in gland than in the United States. Women are employed in the ration of light machines for threading, turning, and pointing ts, and for tapping and facing nuts. From 10,000 to 20,000 nen are engaged in this work in Birmingham and the Black ntry. Men are employed for forging the bolts and nuts and for rating the bolt-heading and cutting machines.

n 1914 female time workers were paid from $1.45 per week for a of 14 years to $2.90 per week for women of 21 years or over. Most of the workers were on piecework and the average prewar nings were between 16s. and 18s. ($3.89 and $4.37) per week of hours. These wages have since risen to about 41s. per week 47 hours, or $8.20, exchange being reckoned at $4 per pound ling.

Germany before the war produced bolts, nuts, and washers on a ge scale and had a large export trade in those articles.

Sweden has developed an important bolt, nut, and rivet industry.

[9] Report of P. M. Tyler to U. S. Tariff Commission.

France before the war had a well-developed nut and bolt industry. Export and import statistics for 1913 indicate that French production of bolts, nuts, screws, and screw eyes combined was in excess of domestic requirements. Exports of these articles were valued at $1,072,000 and imports at only $244,000.

IMPORTS.

Imports of bolts and hinges have been small. The greatest imports, in value, of "bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, of iron or steel," in any year from 1907 to 1921 were 618,444 pounds, valued at $57,761, in 1920.

The smallest imports during this period were 108,606 pounds, valued at $8,509, in 1909.

The greatest imports of "nuts and washers of wrought iron or steel" in the period from 1907 to 1921 were 375,555 pounds, valued at $14,018, in 1915. The smallest imports were 24,618 pounds, valued at $2,553, in 1907.

Spiral nut locks and lock washers have been separately specified only since 1914. In that year imports amounted to 13,309 pounds, valued at $1,684. After 1914 imports declined, amounting in 1919 to only 200 pounds, valued at $13. In 1920 imports increased to 1,741 pounds, valued at $767, and in 1921 to 2,651 pounds, valued at $564.

The imports of these various articles may be considered negligible when compared with the much greater value of production and exports.

PRICES.

Prices of nuts, bolts, washers, and rivets of iron or steel are quoted in discounts from basic price lists. Discounts at the close of 1921 from the lists on pages 33–36 were:

Nuts, up to 1¼ and 1½ inches, inclusive:		
Hot pressed, square blank		$5.50
Hot pressed, square tapped		5.00
Hot pressed, hexigon blank		5.50
Hot pressed, hexigon tapped		5.00
Cold pressed, square tapped		5.00
Cold pressed, square blank		5.25
Cold pressed, hexigon tapped		5.00
Cold pressed, hexigon blank		5.25
Bolts, carriage, ¾ by 6 inches, smaller and shorter:		
Cut thread	per cent	65–10 to 70
Bolts, machine, ¾ by 4 inches, hot-pressed nuts:		
Cut thread	per cent	70–5 to 70–10
Bolts, machine, ¾ by 4 inches, cold-punched nuts:		
Cut thread	per cent	65–5
Washers, wrought, cut:		
200-pound kegs		$4.50
Rivets, small	per cent	60

Some price statistics on cast-iron spring holdback hinges and gate hinges from Price Bulletin No. 33 of the War Industries Board are given. Gate hinges show no advance in price from January, 1913, to March, 1916, when the price rose from $2 to $2.20 per dozen. In June, 1916, the price rose to $2.40 and remained at that level until the end of 1918. The price of cast-iron spring holdback hinges remained stationary at $5.75 per gross from January, 1913, to April, 1916, when it advanced to $7.50. After several more advances the price of these hinges reached $12.60 per gross in April, 1918.

TARIFF HISTORY.

By the act of 1894 bolts, with or without threads or nuts, bolt anks, hinges, and hinge blanks, of iron or steel, were made dutiable 1½ cents per pound. Nuts and washers of iron or steel were made utiable at 25 per cent ad valorem.

By the act of 1897 the duty of 1½ cents per pound on bolts and nges was retained, and a specific duty of 1 cent per pound was bstituted for the ad valorem rate of 25 per cent on nuts and washers.

The act of 1909 reduced the rate on bolts and hinges to 1⅛ cents r pound and on nuts and washers to ¾ of 1 cent per pound.

The act of 1913 substituted for the specific duties of the act of 09 the following ad valorem rates:

On nuts or nut blanks and washers, 5 per cent ad valorem; on lts of iron or steel with or without threads or nuts, bolt blanks, ished hinges, and hinge blanks, 10 per cent ad valorem; and on iral nut locks and lock washers of iron or steel, 30 per cent ad lorem.

The ad valorem rate of 5 per cent on nuts and washers, and of per cent on bolts and hinges represented substantial reductions rate below the duties imposed by the act of 1909. The effect of ese reductions upon imports hardly had time to make itself felt en the trade was disturbed by the war. The quantity of imports bolts and hinges was greater in 1913 than in any of the six years reafter. In 1914, however, the value of these imports slightly ceeded their value in 1913. The quantity of imports of nuts and shers was greater in 1915 than in any year from 1907 to 1914, t decreased thereafter.

COMPETITIVE CONDITIONS.

The United States is the world's largest producer of bolts, nuts, shers, and hinges, not only supplying its own enormous market t exporting in great quantities to foreign countries. The strong sition of the American manufacturer is shown by the fact that nerican exports of bolts, nuts, rivets, and washers have been heavy t only to such countries as Mexico, Canada, Cuba, and Argentina, t also to England, more of these articles having been exported to gland in 1913 than to any other country.

The strength of the position of the American producers is derived ainly from the following facts:

(1) They control the greatest domestic market in the world, and ve developed the industry on a large scale.

(2) They make extensive use of labor-saving machinery, reducing e labor cost.

(3) Raw material, iron and steel, represents the most important ement in cost and has been cheaper here than in competing countries.

(4) American producers were fortified financially by several years prosperity, while the industry in some of the leading competing untries was hurt by the war.

TARIFF CONSIDERATIONS.

At the tariff hearings in 1913 manufacturers of spiral nut locks sked that their product be separately specified and given a higher ate of duty than nuts or washers on the grounds that the production

of nut locks required greater care and more skilled labor than the production of nuts or washers. On the strength of these representations Congress provided for a duty of 30 per cent ad valorem on spiral nut locks and lock washers as compared with a duty of 5 per cent on nuts and washers.

Production of bolts, nuts, washers, and rivets of iron or steel in the United States.

[From Federal Census.]

Year.	Made in steel works and rolling mills.		Not made in steel works or rolling mills.	Made in other establishments.	Total.
	Quantity.	Value.	Value.	Value.	Value.
	Kegs.[1]				
1904 [2]	3,105,827	$13,854,635	$14,687,000		$28,541,635
1909 [3]	4,171,985	20,538,858	24,485,000	$1,257,179	46,281,037
1914	2,091,533	9,682,385	23,403,000	1,062,080	34,147,465

[1] Kegs of 200 pounds.

Iron and steel bolts, nuts, washers, and rivets not made in steel works or rolling mills—Production in United States.

[From Federal Census.]

State.	1899	1904	1909	1914
Connecticut	$1,330,000	$440,000	$1,180,000	$1,018,000
Illinois		474,000	1,955,000	1,282,000
Indiana				1,485,000
Massachusetts	1,835,000	2,044,000	2,427,000	2,207,000
New Jersey		44,000	235,000	254,000
New York	2,026,000	2,448,000	2,967,000	2,902,000
Ohio	2,800,000	4,196,000	6,257,000	4,621,000
Pennsylvania	3,502,000	3,117,000	5,118,000	6,582,000
Rhode Island		908,000	1,341,000	988,000
All other	2,485,000	1,016,000	3,005,000	1,913,000
Total	13,978,000	14,687,000	24,485,000	25,403,000

Bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, of iron or steel—Imports for consumption—Revenue.

Year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Pounds.*				*Per cent.*
1907	1½ cents per pound.	287,781.00	$14,993.95	$4,316.74	$0.052	28.79
1908	do	181,208.00	10,347.00	2,718.17	.057	26.27
1909	do	108,606.00	8,509.38	1,629.17	.078	19.14
1910 [1]	do	3,338.00	804.00	50.07	.241	6.22
1910 [2]	1½ cents per pound.	192,686.00	10,745.14	2,167.78	.056	20.18
1911	do	345,123.47	13,357.78	3,892.78	.039	29.14
1912	do	188,607.50	10,306.29	2,121.91	.055	20.59
1913	do	430,123.00	18,467.00	4,838.92	.043	26.20
1914 [3]	do	150,341.00	5,587.05	1,691.30	.037	30.27
1914 [4]	10 per cent	265,068.00	15,535.50	1,553.50	.059	10.00
1915	do	370,793.00	13,671.00	1,367.10	.037	10.00
1916	do	351,350.00	18,509.00	1,850.90	.053	10.00
1917	do	305,747.00	17,309.00	1,730.90	.057	10.00
1918	do	209,489.00	13,086.00	1,308.60	.062	10.00
Calendar years:						
1918	do	110,306.00	8,253.00	825.00	.075	10.00
1919	do	147,369.00	17,433.00	1,743.00	.118	10.00
1920	do	618,444.00	57,761.00	5,776.00	.093	10.00
1921	do	437,746.00	41,465.00	4,146.50	.095	10.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Nuts and washers, of wrought iron or steel—Imports for consumption—Revenue.

Years.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Pounds.*				*Per cent.*
1907	1 cent per pound	24,618	$2,553.00	$246.18	$0.104	9.64
1908	do	34,001	5,796.00	340.01	.17	5.86
1909	do	30,017	5,677.00	300.17	.189	5.29
1910 [1]	do	4,692	744.00	46.92	.159	6.31
1910 [2]	½ cent per pound	47,883	8,609.00	359.16	.180	4.17
1911	do	184,322	12,847.45	1,382.46	.070	10.76
1912	do	128,173	16,017.00	961.31	.125	6.00
1913	do	117,908	16,257.00	884.35	.138	5.44
1914 [3]	do	57,131	4,502.50	428.51	.079	9.52
1914 [4]	5 per cent	136,899	9,618.00	480.90	.07	5.00
1915	do	375,555	14,018.00	700.90	.037	5.00
1916	do	94,186	9,839.00	491.95	.104	5.00
1917	do	81,788	9,275.00	463.75	.113	5.00
1918	do	45,852	8,432.00	421.60	.183	5.00
Calendar years:						
1918	do	36,338	11,512.00	576.00	.317	5.00
1919	do	65,399	15,207.00	760.00	.233	5.00
1920	do	78,924	12,601.00	630.00	.160	5.00
1921	do	179,521	11,327.00	566.35	.063	5.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1910.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[5] Nut blanks included after Oct. 3, 1913.

Spiral nut locks and lock washers—Imports for consumption—Revenue.

Years.	Rate of duty.	Quantity[5].	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal years:		*Pounds.*				*Per cent.*
1914	30 per cent	13,309	$1,684.00	$505.20	$0.127	30.00
1915	do	6,598	342.00	102.60	.052	30.00
1916	do	1,155	88.00	26.40	.076	30.00
1917	do	340	50.00	15.00	.147	30.00
1918	do	996	86.00	25.80	.087	30.00
Calendar years:						
1918	do	200	18.00	5.00	.090	30.00
1919	do	700	28.00	8.00	.040	30.00
1920	do	1,566	761.00	228.00	.486	30.00
1921	do	2,651	564.00	169.20	.213	30.00

Bolts, nuts, rivets, and washers [1]—Domestic exports.

FISCAL YEARS.

Exported to—	1913		1914		1915	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
England	7,557,347	$307,488	7,461,251	$312,898	9,555,976	$369,962
Canada	6,440,375	218,805	5,206,745	181,072	2,458,330	90,572
Panama	4,285,785	126,121	3,221,273	98,694	1,877,449	53,294
Mexico	6,333,025	230,380	3,482,547	141,891	1,502,835	60,418
Cuba	5,976,723	190,435	5,820,769	189,095	4,241,085	127,102
Argentina	5,205,284	172,243	4,858,499	174,151	1,481,038	57,265
Chile	783,209	29,421	1,011,037	35,986	471,325	14,374
China	114,889	4,021	178,261	5,630	96,791	3,260
British Indies	350,358	15,361	525,580	22,482	968,632	44,957
Dutch East Indies	30,766	1,309	39,464	1,452	57,343	2,714
Hongkong	14,526	490	3,477	99	7,622	279
Japan	471,797	14,136	592,640	24,172	137,658	5,292
Australia	2,987,929	106,315	4,064,641	150,649	2,010,549	80,935
Philippine Islands	1,115,457	36,038	1,152,387	37,046	806,659	23,054
British South Africa	707,173	24,934	905,165	33,455	610,151	24,415
All other	6,084,069	222,699	5,889,311	226,935	3,956,976	148,577
Total	48,458,712	1,700,205	44,413,047	1,635,707	30,240,419	1,106,470

[1] Included in all other manufactures of iron and steel prior to 1913.

Bolts, nuts, rivets, and washers—Domestic exports—Continued.

FISCAL YEARS—Continued.

Exported to—	1916		1917		1918	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	
England	15,293,219	$636,261	9,251,934	$552,270	5,705,010	
Canada	7,451,407	262,987	8,765,645	704,074	9,347,282	
Panama	2,597,651	89,558	2,225,544	126,579	658,324	
Mexico	1,253,540	59,135	1,712,308	118,067	2,983,644	
Cuba	6,691,085	261,335	10,631,738	566,030	8,241,267	
Argentina	3,309,639	146,147	3,265,752	210,213	1,600,032	
Chile	1,676,424	61,580	4,158,571	223,953	4,951,677	
China	1,481,774	43,387	829,595	45,983	2,139,912	
British India	5,670,732	198,782	2,628,849	156,726	3,944,227	
Dutch East Indies	131,254	7,262	818,494	55,256	1,737,958	
Hongkong	435,963	14,568	884,176	52,184	2,468,328	
Japan	1,069,517	32,773	800,993	50,380	7,864,616	
Australia	5,086,388	185,797	3,753,015	211,184	2,473,841	
Philippine Islands	1,760,728	60,829	579,080	36,525	1,282,382	
British South Africa	2,531,891	94,879	2,854,384	141,000	1,332,474	
All other	12,648,972	423,104	13,011,733	794,112	10,722,715	
Total	69,090,195	2,378,386	66,131,801	4,044,586	67,551,393	

CALENDAR YEARS.

Exported to—	1919		1920		1921	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	
France	2,602,839	$176,722	90,494	$14,623	30,216	
England	10,588,948	968,860	7,751,353	648,700	7,832,764	
Canada	10,406,363	885,555	7,114,988	745,420	2,889,681	
Mexico	4,323,788	377,962	5,441,361	549,801	7,962,310	
Cuba	8,096,051	597,147	15,485,347	1,282,309	5,440,367	
Argentina	4,602,530	488,642	3,345,571	544,354	5,152,248	
Chile	4,782,863	391,754	2,288,471	178,020	1,636,404	
China	5,388,734	403,176	5,831,035	223,424	1,302,909	
British India	5,598,894	435,021	3,108,500	208,704	1,709,369	
Dutch East Indies	3,938,169	279,412	1,621,539	139,179	1,090,345	
Hongkong	942,583	84,011	987,934	58,583	1,406,225	
Japan	4,594,458	390,643	4,603,385	330,722	1,377,638	
Australia	3,531,905	380,600	2,268,625	232,547	4,258,886	
Philippines	2,739,307	255,657	2,572,741	241,116	1,418,568	
British South Africa	2,447,758	219,095	1,337,780	130,772	933,530	
All other	14,438,146	1,325,640	21,385,698	1,080,136	9,157,468	
Total	89,023,050	7,769,893	87,235,028	7,274,411	54,276,882	

Hinges, spring hold-back, cast iron—Prices per gross, wholesale.

[From War Industries Board Price Bulletin No. 33. Prices of Iron, Steel, and Their Products

	1913	1914	1915	1916	1917	
Year	$5.75	$5.75	$5.75	$7.00	$8.60	
Quarter:						
First	5.75	5.75	5.75	5.75	7.75	
Second	5.75	5.75	5.75	7.50	8.25	
Third	5.75	5.75	5.75	7.50	9.12	
Fourth	5.75	5.75	5.75	7.50	9.60	
Month:						
January	5.75	5.75	5.75	5.75	7.50	
February	5.75	5.75	5.75	5.75	7.50	
March	5.75	5.75	5.75	5.75	8.25	
April	5.75	5.75	5.75	7.50	8.25	
May	5.75	5.75	5.75	7.50	8.25	
June	5.75	5.75	5.75	7.50	8.25	
July	5.75	5.75	5.75	7.50	8.25	
August	5.75	5.75	5.75	7.50	9.60	
September	5.75	5.75	5.75	7.50	9.60	
October	5.75	5.75	5.75	7.50	9.60	
November	5.75	5.75	5.75	7.50	9.60	
December	5.75	5.75	5.75	7.50	9.60	

Gate hinges with latch, western—Prices per dozen, wholesale.

[From War Industries Board Price Bulletin No. 33. Prices of Iron, Steel and Their Products.]

	1913	1914	1915	1916	1917	1918
[illegible]	$2.00	$2.00	$2.00	$2.2833	$2.40	$2.40
[illegible]rter:						
First	2.00	2.00	2.00	2.0667	2.40	2.40
[illegible]econd	2.00	2.00	2.00	2.2667	2.40	2.40
Third	2.00	2.00	2.00	2.40	2.40	2.40
Fourth	2.00	2.00	2.00	2.40	2.40	2.40
[illegible]th:						
January	2.00	2.00	2.00	2.00	2.40	2.40
February	2.00	2.00	2.00	2.00	2.40	2.40
March	2.00	2.00	2.00	2.20	2.40	2.40
April	2.00	2.00	2.00	2.20	2.40	2.40
May	2.00	2.00	2.00	2.20	2.40	2.40
June	2.00	2.00	2.00	2.40	2.40	2.40
July	2.00	2.00	2.00	2.40	2.40	2.40
August	2.00	2.00	2.00	2.40	2.40	2.40
September	2.00	2.00	2.00	2.40	2.40	2.40
October	2.00	2.00	2.00	2.40	2.40	2.40
November	2.00	2.00	2.00	2.40	2.40	2.40
December	2.00	2.00	2.00	2.40	2.40	2.40

BASE PRICES.

[illegible]nited States standard list of hot pressed square nuts, U. S. S. or Whitworth threads.

[Amended Dec. 20, 1905, to take effect Jan. 1, 1906.]

[illegible]hort [illegible]meter.	Thick-ness.	Hole.	Size of bolt.	Price per 100 pounds.		
				Blank.	Tapped.	Reamed.
¼	¼	7/32 scant	¼	$13.00	$15.00	$13.80
5/16	5/16	9/32 scant	5/16	12.00	13.50	12.80
3/8	5/16	11/32 scant	3/8	10.50	11.60	11.00
7/16	7/16	13/32	7/16	10.00	10.90	10.50
½	½	15/32 scant	½	9.00	9.70	9.30
9/16	9/16	17/32	9/16	9.00	9.60	9.30
5/8	⅝	⅝ full	⅝	8.70	9.20	8.90
11/16	⅝	⅝ scant	¾	8.50	8.90	8.60
¾	⅝	21/32 scant	¾	8.40	8.80	8.60
¾	¾	¾ scant	1	8.40	8.80	8.60
1 1/16	1	1 1/32 full	1 1/16	8.40	8.80	8.60
1 1/8	1	1 1/32 full	1 1/8	8.40	8.80	8.80
1 3/16	1	1 3/32 full	1 3/16	8.50	9.00	8.80
1¼	1	1 3/32 full	1¼	8.80	9.40	9.60
1 5/16	1	1 7/32 scant	1 5/16	9.00	9.70	9.60
1⅜	1	1 7/32 scant	1⅜	9.30	10.00	10.20
1 7/16	1	1 7/32 scant	1 7/16	9.50	10.30	10.20
1½	1	1 11/32 scant	1½	9.70	10.60	10.60
1 9/16	1	1 11/32 scant	1 9/16	10.00	11.00	11.00
1⅝	1	1 11/32 scant	1⅝	10.00	11.10	11.50
1 11/16	1	1 11/32 scant	1 11/16	10.30	11.50	12.00
1¾	1	1 15/32 scant	1¾	10.50	11.80	12.20
1 13/16	1	1 15/32 scant	1 13/16	11.00	12.40	12.70
1⅞	1	1 15/32 scant	1⅞	11.50	13.00	13.20

[illegible]or less than keg lots (200 pounds) of a size, add 20 cents per hundredweight for 100 pounds or over; 50 [illegible]nts per hundredweight for less than 100 pounds.

United States standard list of hot pressed hexagon nuts, U. S. S. or Whitworth [illegible]

[Amended Dec. 20, 1905, to take effect Jan. 1, 1906.]

Short diameter.	Thickness.	Hole.	Size of bolt.	Price per 100 pounds.		
				Blank.	Tapped.	[illegible]
[illegible]	[illegible]	[illegible] scant	[illegible]	$20.00	$22.50	[illegible]
[illegible]	[illegible]	[illegible] scant	[illegible]	18.00	20.00	
[illegible]	[illegible]	[illegible] scant	[illegible]	14.00	15.60	
[illegible]	[illegible]	[illegible]	[illegible]	13.00	14.30	
[illegible]	[illegible]	[illegible] scant	[illegible]	11.20	12.20	
[illegible]	[illegible]	[illegible]	[illegible]	11.20	12.10	
[illegible]	[illegible]	[illegible] full	[illegible]	10.50	11.20	
[illegible]	[illegible]	[illegible] scant	[illegible]	10.00	10.60	
[illegible]	[illegible]	[illegible] scant	[illegible]	9.90	10.50	
[illegible]	[illegible]	[illegible] scant	1	9.90	10.50	
[illegible]	[illegible]	[illegible] full	[illegible]	9.90	10.50	
[illegible]	[illegible]	[illegible] full	[illegible]	9.90	10.50	
[illegible]	[illegible]	[illegible] full	[illegible]	10.00	10.70	
[illegible]	[illegible]	[illegible] full	[illegible]	10.30	11.10	
[illegible]	[illegible]	[illegible] scant	[illegible]	10.50	11.40	
[illegible]	[illegible]	[illegible] scant	[illegible]	10.80	11.70	
[illegible]	[illegible]	[illegible] scant	[illegible]	11.00	12.00	
[illegible]	[illegible]	[illegible] scant	2	11.20	12.30	
[illegible]	[illegible]	[illegible] scant	[illegible]	11.70	12.90	
[illegible]	[illegible]	[illegible] scant	[illegible]	11.70	13.00	
[illegible]	[illegible]	[illegible]	[illegible]	12.20	13.60	
[illegible]	[illegible]	[illegible]	[illegible]	12.40	13.90	
[illegible]	[illegible]	[illegible]	[illegible]	13.00	14.60	
[illegible]	3	[illegible]	3	13.50	15.20	
5	[illegible]	[illegible]	[illegible]	16.00	17.80	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	16.00	17.90	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	17.00	18.90	[illegible]
[illegible]	4	[illegible]	4	17.00	18.90	[illegible]

For less than keg lots (200 pounds) of a size, add 20 cents per hundredweight for 100 pounds or [illegible] cents per hundredweight for less than 100 pounds.

Plain cold punched nuts for cars and unfinished work, United States standard sizes p[illegible] for U. S. S. or Whitworth threads.

[Amended Dec. 20, 1905, to take effect Jan. 1, 1906.]

Width.	Thickness.	Hole.	Bolt.	Square, price per 100 pounds.		Hexagon, price per 100 pounds.	
				Blank.	Tapped.	Blank.	Tapped.
[illegible]	[illegible]	[illegible]	[illegible]	$13.80	$15.80	$21.00	$23.50
[illegible]	[illegible]	[illegible]	[illegible]	12.80	14.30	19.00	21.00
[illegible]	[illegible]	[illegible]	[illegible]	11.00	12.10	14.70	16.30
[illegible]	[illegible]	[illegible]	[illegible]	10.50	11.40	13.70	15.00
[illegible]	[illegible]	[illegible]	[illegible]	9.30	10.00	11.50	12.50
[illegible]	[illegible]	[illegible]	[illegible]	9.30	9.90	11.50	12.40
[illegible]	[illegible]	[illegible]	[illegible]	8.90	9.40	10.70	11.40
[illegible]	[illegible]	[illegible]	[illegible]	8.60	9.00	10.20	10.80
[illegible]	[illegible]	[illegible]	[illegible]	8.60	9.00	10.20	10.80
[illegible]	[illegible]	[illegible]	[illegible]	8.60	9.00	10.20	10.80
[illegible]	[illegible]	[illegible]	1	8.60	9.00	10.20	10.80
[illegible]	[illegible]	[illegible]	[illegible]	8.60	9.00	10.20	10.80
[illegible]	[illegible]	[illegible]	[illegible]	8.80	9.20	10.50	11.10
[illegible]	[illegible]	[illegible]	[illegible]	8.80	9.30	10.50	11.20
[illegible]	[illegible]	[illegible]	[illegible]	9.60	10.20	11.30	12.10
[illegible]	[illegible]	[illegible]	[illegible]	9.60	10.30	11.30	12.20
[illegible]	[illegible]	[illegible]	[illegible]	10.20	10.90	12.10	13.00
[illegible]	[illegible]	[illegible]	[illegible]	10.20	11.00	12.10	13.10
[illegible]	2	[illegible]	2	10.60	11.50	12.60	13.70
[illegible]	[illegible]	[illegible]	[illegible]	11.00	12.00	13.00	14.20
[illegible]	[illegible]	[illegible]	[illegible]	11.50	12.60	13.50	14.80

Nuts with holes differing from standard sizes, or tapped with special threads, extra. Larg[illegible] charged at same rate as chamfered and trimmed nuts.

Manufacturers' standard list of carriage bolts—Price per hundred.

[Revised list in effect Nov. 1, 1912.]

Length, in inches.	⅜	7/16	½	9/16	⅝	¾ and ⅞	1
1½	$1.00	$1.40	$1.90	$2.20			
2	1.10	1.52	2.06	2.40			
2½	1.20	1.64	2.22	2.60	$3.25	$5.75	$8.50
3	1.30	1.76	2.38	2.80	3.53	6.13	9.00
3½	1.40	1.88	2.54	3.00	3.81	6.51	9.50
4	1.50	2.00	2.70	3.20	4.09	6.89	10.00
4½	1.60	2.12	2.86	3.40	4.37	7.27	10.50
5	1.70	2.24	3.02	3.60	4.65	7.65	11.00
5½	1.80	2.36	3.18	3.80	4.93	8.03	11.50
6	1.90	2.48	3.34	4.00	5.21	8.41	12.00
6½	2.00	2.60	3.50	4.20	5.49	8.79	12.50
7	2.10	2.72	3.66	4.40	5.77	9.17	13.00
7½	2.20	2.84	3.82	4.60	6.05	9.55	13.50
8	2.30	2.96	3.98	4.80	6.33	9.93	14.00
8½	2.40	3.08	4.14	5.00	6.61	10.31	14.50
9	2.50	3.20	4.30	5.20	6.89	10.69	15.00
9½	2.60	3.32	4.46	5.40	7.17	11.07	15.50
10	2.70	3.44	4.62	5.60	7.45	11.45	16.00
11	2.90	3.68	4.94	6.00	8.01	12.21	17.00
12	3.10	3.92	5.26	6.40	8.57	12.97	18.00
13	3.30	4.16	5.58	6.80	9.13	13.73	19.00
14	3.50	4.40	5.90	7.20	9.69	14.49	20.00
15	3.70	4.64	6.22	7.60	10.25	15.25	21.00
16	3.90	4.88	6.54	8.00	10.81	16.01	22.00
17	4.10	5.12	6.86	8.40	11.37	16.77	23.00
18	4.30	5.36	7.18	8.80	11.93	17.53	24.00
19	4.50	5.60	7.50	9.20	12.49	18.29	25.00
20	4.70	5.84	7.82	9.60	13.05	19.05	26.00

lts with hexagon nuts, 15 per cent extra. Intermediate lengths take next higher list. Larger an ⅞ inch take machine-bolt list.

rers' standard list of machine bolts with square heads and square nuts—Finished points—Price per hundred.

[Revised list in effect Aug. 1, 1912.]

¼	5/16	⅜	7/16	½	9/16 and ⅝	¾	⅞	1	1¼	1½
.70	$2.00	$2.40	$2.80	$3.60	$5.20	$7.70	$10.50	$15.10	$22.50	$30.00
.78	2.12	2.56	3.00	3.86	5.58	8.25	11.20	16.00	23.70	31.50
.86	2.24	2.72	3.20	4.12	5.96	8.80	11.90	16.90	24.90	33.00
.94	2.36	2.88	3.40	4.38	6.34	9.35	12.60	17.80	26.10	34.50
.02	2.48	3.04	3.60	4.64	6.72	9.90	13.30	18.70	27.30	36.00
.10	2.60	3.20	3.80	4.90	7.10	10.45	14.00	19.60	28.50	37.50
.18	2.72	3.36	4.00	5.16	7.48	11.00	14.70	20.50	29.70	39.00
.26	2.84	3.52	4.20	5.42	7.86	11.55	15.40	21.40	30.90	40.50
.34	2.96	3.68	4.40	5.68	8.24	12.10	16.10	22.30	32.10	42.00
.42	3.08	3.84	4.60	5.94	8.62	12.65	16.80	23.20	33.30	43.50
.50	3.20	4.00	4.80	6.20	9.00	13.20	17.50	24.10	34.50	45.00
.58	3.32	4.16	5.00	6.46	9.38	13.75	18.20	25.00	35.70	46.50
.66	3.44	4.32	5.20	6.72	9.76	14.30	18.90	25.90	36.90	48.00
.74	3.56	4.48	5.40	6.98	10.14	14.85	19.60	26.80	38.10	49.50
.90	3.80	4.80	5.80	7.50	10.90	15.95	21.00	28.60	40.50	52.50
.06	4.04	5.12	6.20	8.02	11.66	17.05	22.40	30.40	42.90	55.50
.22	4.28	5.44	6.60	8.54	12.42	18.15	23.80	32.20	45.30	58.50
.38	4.52	5.76	7.00	9.06	13.18	19.25	25.20	34.00	47.70	61.50
....	.....	6.08	7.40	9.58	13.94	20.35	26.60	35.80	50.10	64.50
....	.....	6.40	7.80	10.10	14.70	21.45	28.00	37.60	52.50	67.50
....	.....	6.72	8.20	10.62	15.46	22.55	29.40	39.40	54.90	70.50
....	.....	7.04	8.60	11.14	16.22	23.65	30.80	41.20	57.30	73.50
....	.....	.....	.....	11.66	16.98	24.75	32.20	43.00	59.70	76.50
....	.....	.....	.....	12.18	17.74	25.85	33.60	44.80	62.10	79.50
....	.....	.....	.....	12.70	18.50	26.95	35.00	46.60	64.50	82.50
....	.....	.....	.....	13.22	19.26	28.05	36.40	48.40	66.90	85.50
....	.....	.....	.....	.....	.....	29.15	37.80	50.20	69.30	88.50
....	.....	.....	.....	.....	.....	30.25	39.20	52.00	71.70	91.50
....	.....	.....	.....	.....	.....	31.35	40.60	53.80	74.10	94.50
....	.....	.....	.....	.....	.....	32.45	42.00	55.60	76.50	97.50

Standard wrought washers, United States standard sizes, in 200-pound kegs.

[Adopted Jan. 20, 1910.]

Outside diameter.	Size of hole.	Thickness wire gauge.	Size of bolt.	Price per 100 pounds.	Estimated number in 100 pounds.
		18 (1/64)		$14.00	39,400
		16 (1/32)		12.20	15,600
		16 (1/32)		11.40	11,250
1		14 (1/16)		10.50	6,800
		14 (1/16)		9.80	4,300
		12 (3/32)		9.40	2,600
		12 (3/32)		9.30	2,250
		10 (1/8)		9.20	1,300
2		9 (9/64)		9.10	900
		8 (5/32)		9.00	782
		8 (5/32)	1	9.00	568
		8 (5/32)		9.00	473
3		8 (5/32)		9.20	364
		7 (11/64)		9.20	275
		7 (11/64)		9.20	256
		7 (11/64)		9.50	220
4		7 (11/64)		9.50	197
	2	7 (11/64)		9.50	174
		7 (11/64)	2	9.50	160
		5 (13/64)		10.50	122
5		4 (1/4)		10.50	106

Add $0.15 hundredweight for 100-pound kegs; $0.30 hundredweight for 50 to 100 pound box hundredweight for 25 to 50 pound boxes; $1 hundredweight for 5-pound paper boxes; $2 hundr for 1-pound paper boxes.

Rivets, standard heads only, in 200-pound kegs.

[List effective May 19, 1920.]

Diameter	Old standard wire gauge.															
	3/8	11/32	5/16	1	2	3	1/4	4	5	6	7/16	7	8	9	10	11	12
	Cents per pound.																
5–3½ inches long	17	18½	18½	19	19	19	19	22	22	22	22	....	....	....	....	....	....
3½–2½ inches long	17	17½	17½	18	18	18	18	20	20	20	20	....	....	....	....	....	....
2–1 inches long	15	15½	15½	16	16	16	16	17	17	17	17	17	18	19	20	21	22
⅞–¾ inches long	15½	16	16	16½	16½	16½	16½	17½	17½	17½	17½	17½	18½	19½	20½	21½	23½
⅝–½ inches long	16	16½	16½	17	17	17	17	18	18	18	18	19	19	20	21	22	25
7/16 inches long	17	17	18	19	19	19	19	19	20	20	20	20	21	22	23	26	28
3/8 inches long	18	18	18	19	19	19	19	20	20	21	21	21	22	23	25	29	31
11/32 inches long	19	19	19	19	19	19	19	20	20	21	21	21	22	23	27	30	32
5/16 inches long	20	20	20	20	20	20	20	20	21	22	22	22	23	25	29	32	34
9/32 inches long	20	20	20	20	20	20	20	20	22	22	22	22	23	25	30	33	36
¼ inches long	....	....	....	....	20	20	20	20	22	23	23	23	24	25	30	33	37
7/32 inches long	....	....	....	....	21	21	21	21	23	24	24	24	25	26	32	35	38
3/16 inches long	....	....	....	....	....	....	21	21	23	25	25	25	26	27	35	39	43
5/32 inches long	....	....	....	....	....	....	....	22	24	25	26	26	27	29	37	42	47
⅛ inches long	....	....	....	....	....	....	....	....	24	25	27	27	28	31	39	44	52
3/32 inches long	....	....	....	....	....	....	....	....	25	26	28	28	29	32	40	47	57

Intermediate lengths and dimaters take list of nearest smaller size.

LIST EXTRAS.

100-pound kegs, add 1 cent to list.
50-pound boxes, add 3 cents to list.
25-pound boxes, add 4 cents to list.

5 or 10 pound packages, add 5 cents to li
1-pound packages, add 8 cents to list.

Nuts, washers, bolts, hinges, spiral nut locks, and lock washers—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	162	Wrought iron or steel * * * nuts, and washers, * * *.....	2 cents per pound.
	164	Iron or steel * * * bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks.	2½ cents per pound.
1890	158	Bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, whether of iron or steel.	2½ cents per pound.
	176	* * * nuts, and washers, * * * of wrought iron or steel...	1.8 cents per pound.
1894	131	Bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, whether of iron or steel.	1½ cents per pound.
	148	* * * nuts, and washers, * * * of wrought iron or steel...	25 per cent ad valorem.
1897	145	Bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, whether of iron or steel.	1½ cents per pound.
	163	* * * nuts, and washers, * * * of wrought iron or steel...	1 cent per pound.
1909	144	Bolts, with or without threads or nuts, or bolt blanks, and finished hinges or hinge blanks, whether of iron or steel.	1¼ cents per pound.
	162	* * * nuts, and washers, * * * of wrought iron or steel...	¾ of 1 cent per pound.
1913	123	Nuts, or nut blanks, and washers.....	5 per cent ad valorem.
		Bolts of iron or steel, with or without threads or nuts, or bolt blanks, finished hinges or hinge blanks.	10 per cent ad valorem.
		Spiral nut locks and lock washers, whether of iron or steel.....	30 per cent ad valorem.

Court and Treasury Decisions.

The provision for "bolts, with or without threads or nuts," was held to include stay or stud bolts (G. A. 2685, T. D. 15159 of 1894); also carriage bolts and step invoiced as "boutons de tirage" (G. A. 1483, T. D. 12932 of 1892). The provision for bolts was declared not limited to those entirely of iron or steel, and was held to include metal heads with a covering of leather and cotton. (Abstract 2850, T. D. 30410 of 1910.) Lock washers, or nut locks, used on automobiles, were held dutiable as washers under the act of 1909. (*United States* v. *Motor Equipment Co.*, 3 Ct. Cust. Appls., 77, of 1912.) Iron washers, with a device to prevent the nut from slipping and having no special adaptation for use on automobiles, were held to come within the provision for washers rather than that for parts of automobiles. (G. A. 7101, T. D. 30933 of 1910.) Door hinges made of steel, with added fittings of bronze, bronze chief value, were held dutiable as manufacture of metal, rather than as "finished hinges or hinge blanks, whether of iron or steel," under the act of 1909 (G. A. 7455, T. D. 33337 of 1913); but copper hinges were held to come within the provision for hinges (G. A. 7733, T. D. 35497 of 1915).

Bolts and nuts imported with blades for pruning shears were held to come within paragraph 391 of the act of 1913 for agricultural implements rather than paragraph 123 as bolts and nuts. (*United States* v. *Ducommun Hardware Co.*, 7 Ct. Cust. Appls., 353.)

Nuts or nut blanks dutiable at 5 per cent under this paragraph are made from bars of steel subject to a duty of 8 per cent under paragraph 110. Nuts or nut blanks or washers, spiral nut locks, or lock washers of any material are covered by this provision.

RIVETS, STUDS, AND STEEL POINTS.

Summary.

The tariff on rivets, studs, and steel points has not been of much significance in the development of the industry in the United States.

American manufacturers are at no disadvantage in competing with foreign countries as regards the supply and availability of raw materials; the methods of manufacture in this country are equally as efficient as the methods employed in competitive countries, and the domestic product is fully as good in quality as that made abroad. The American manufacturer has the advantage of an import duty of 20 per centum ad valorem and the location in the midst of the largest world market.

England, Belgium, and Germany are the principal foreign producing countries. The competitive strength of these countries lies in their lower productive labor costs, and has been augmented by the depreciation in the United States of the currency of these European countries.

The industry in the United States numbers several hundred factories, and although widely distributed throughout the country, is most largely located east of the Mississippi River and north of the Ohio River. The total amounts of annual production and capital invested are not known, as the industry is allied with the manufacture of other articles, chief among which are bolts, nuts, washers, cotter pins, and rolling-mill products.

Ordinary rivets are similar to unthreaded bolts in appearance, although various heads are provided. They are a bulk product made in quantity from wire rods or wire by automatic machinery. Special studs chiefly for ornamental purposes and steel points for automobile tires are not used in considerable quantities. They are more highly finished products than ordinary rivets, and labor constitutes a larger fraction of the cost of production.

Rivets, studs, and steel points—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption.	Domestic exports.[1]	Value (imports for consumption).	Amount of duty.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.					*Per cent.*
1909	.....	104,940	.....	$18,165	$7,257.36	(1)	39.96
1911	.....	(1)	.....	9,742	3,872.70	(1)	39.75
1912	.....	(1)	.....	14,816	6,555.66	(1)	44.25
1913	.....	(1)	.....	10,110	4,308.55	(1)	42.61
1914	.....	(1)	.....	8,797	2,509.55	(1)	28.53
1915	.....	(1)	.....	4,215	843.00	(1)	20.00
1916	.....	(1)	.....	5,752	1,150.40	(1)	20.00
1917	.....	(1)	.....	10,830	2,166.00	(1)	20.00
1918	.....	(1)	.....	8,600	1,720.00	(1)	20.00
1919	.....	112,136	.....	7,632	1,526.40	$0.068	20.00
1920	.....	61,789	.....	6,594	1,318.80	.107	20.00
1921	.....	30,175	.....	2,504	500.80	.082	20.00

[1] Statistics not available.

General Information.

TARIFF PARAGRAPHS, ACT OF 1913.

PAR. 138. Rivets, studs, and steel points, lathed, machined, or brightened, and rivets or studs for nonskidding automobile tires, and rivets of iron or steel, not specially provided for in this section, 20 per centum ad valorem.

PAR. 167. Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of * * * copper, * * * or other metal, * * * and whether partly or wholly manufactured, 20 per centum ad valorem.

DESCRIPTION.

A *rivet* is a short metallic malleable pin, of wrought iron, copper, or other metal, used to fasten two or more pieces of material firmly together. Rivets are usually headed at one end, the other end being hammered out after having passed through the materials to be joined.

Rivets are of numerous styles and sizes. The ordinary iron or steel rivet differs from a bolt chiefly in that a bolt has screw threads at one or both ends to hold a nut, whereas the end, or point, of a rivet is smooth. The heads and points of rivets have distinctive names, some of which are as follows: Cone head, button head, countersunk head (chipped flush), ordinary countersunk head, snap head, snap head with conical or swelled neck, pan head, pan head with conical or swelled neck, countersunk point, rough hammered point, snap point (handwork), and snap point (machine work).

Rivets for use in material, such as leather or cloth of various kinds, are commonly tubular or bifurcated, made from copper or copper-plated iron. Certain kinds of rivets are blacked, tinned, or galvanized.

In some places rivets can not be driven into place and properly hammered up; resort is then made to rivets which have screw points, called "tap rivets."

A *stud* is a kind of nail with a large head, used chiefly for ornament; also, a short article of malleable iron which, in size and appearance, closely resembles a link cuff button. The latter kind of studs is used to join together the two ends in machinery belts.

The term "steel points" is nontechnical and self-explanatory.

Substitutes.—In iron work bolts are sometimes employed in place of rivets, and in fabrics sewing with thread is often employed instead of rivets. Belt studs are displaced either by sewing or by staggered point steel belt lacing.

DOMESTIC PRODUCTION.

The manufacture of rivets, studs, and steel points is not conducted as a separate industry in the United States, but is allied with the manufacture of bolts, nuts, and other articles. Statistics of the total capital invested and amount of annual production are therefore not available.

In 1914 there were 102 establishments in the United States whose principal products were bolts, nuts, rivets, lock washers, cotter pins, staples, gaskets, floor caps, and similar articles. The average number of wage earners employed was 10,658, the capital invested, $35,602,329, and the value of *products*, $23,403,405. In addition to the output of *these establishments, rolling mills* produced bolts, nuts, washers, and

rivets to the value of $9,682,385, and the output of establishments engaged primarily in the manufacture of other products was $1,062,080; making a total output amounting to $34,147,870.

Raw materials.—The principal materials for iron or steel rivets, belt studs, and the lower part of ornamental studs are malleable iron or steel rods and wire, and for copper rivets the material is copper wire. Bronze is the principal material used in the tops of ornamental studs. In ordinary times the domestic supply is adequate for the demand.

Equipment.—So far as known all equipment and machinery used are manufactured in the United States.

Methods of production.—Rivets are manufactured by both cold and hot processes and by the employment of a certain amount of automatic machinery. Studs commonly have the tops cast over the head of the nail, after which they are carefully trimmed and polished by the use of machinery.

Organization.—The efficient conduct of the business does not require large factories or great amounts of capital; in fact, from an economical standpoint, a moderate-sized plant is probably the best.

A large market exists in the United States for rivets of all kinds, especially for iron or steel rivets of which great quantities are used in the manufacture of boilers and tanks, and in shipbuilding. The market for rivets or studs for automobile tires is small in this country, most of the domestic production finding an outlet in foreign countries.

The capital invested is scattered among several hundred firms which also produce other articles. The total amount invested in the manufacture of rivets, studs, and steel points is not known.

Geographical distribution.—The industry is widely distributed throughout the United States, the manufacture of these articles being carried on most extensively in that part of the country lying east of the Mississippi River and north of the Ohio River.

Domestic production and consumption.—The amounts and values of the total domestic production and consumption are not available; in ordinary times, however, the production is more than sufficient to supply the domestic demand.

Domestic exports.—Separate statistics for exports of rivets, studs, and steel points are not available. Published official statistics include rivets, bolts, nuts, and washers, of which 78,024,502 pounds were exported in the fiscal year 1920. This amount is somewhat smaller than the amount exported in 1919, but is much larger than the amounts exported annually before the war—48,458,712 pounds in 1913 and 44,413,047 pounds in 1914. Beginning in 1916 the annual shipments to foreign countries show decided increases as compared with the pre-war trade, reaching the highest figure in 1919—90,213,960 pounds. The increased trade after the war is due chiefly to decreased output in the principal foreign producing countries.

The exports mentioned above were to countries in practically all parts of the world, chief among which were the United Kingdom, Canada, Cuba, British India, China, Chile, Argentina, Japan, and Mexico.

FOREIGN PRODUCTION.

England, Germany, and Belgium are the principal foreign countries producing iron or steel rivets. The products of these countries, however, enter into competition with the American product chiefly in foreign markets, as very few foreign iron or steel rivets are sold

he United States. The quality of the domestic product is said to equally as good or superior to that of the foreign.

oreign automobile studs competing with the American product he United States are made chiefly in Switzerland. Swiss studs said to be entirely satisfactory, a question of price only being olved.[10]

IMPORTS.

n the fiscal year 1920 the total imports of rivets, studs, and steel nts amounted to 61,789 pounds. Of this amount 34,555 pounds, nearly 56 per cent, were studs and steel points lathed, machined, brightened, and rivets or studs for nonskidding automobile tires. e total amounts imported have decreased annually since 1917, the rease in the last fiscal year being from 112,136 pounds in 1919 to 789 pounds in 1920, or nearly 45 per cent. The decreases were fined entirely to rivets other than for automobile tires, whereas ds, steel points, and rivets for nonskidding automobile tires increased ually during this period, the increase of 1920 over 1919 amounted 22 per cent.

Rivets are imported chiefly from England, Germany, and Belgium, l automobile tire studs or rivets from Switzerland, but the total ounts annually imported are not known.

PRICES.

Prices of structural rivets, boiler rivets, and small rivets ($\frac{7}{16}$-inch l under) are quoted regularly in the trade journals.[11] In general, se prices follow the wire-rod market fluctuations.

COMPETITIVE CONDITIONS.

Rivets are a bulk product made in large quantities by automatic chinery. The main item in the cost of production is the cost of w materials, either wire rods or wire. Foreign competition in these es is negligible since domestic raw materials are ordinarily as eap as foreign, and the additional cost of transportation of these lky articles probably offsets any advantage which the foreign nufacturer may have in labor costs.

Automobile tire studs as well as the various ornamental studs are t made in such large quantities. When highly polished or ma- ined, the differential between the cost of raw materials and the st of the finished product is much greater and allows a greater portunity for the foreign manufacturer, who, especially under the sent exchange situation, has a marked advantage in lower wages l in many instances lower labor costs. For many of these more hly finished products the foreign market is greater than the erican market so the foreign manufacturer may get the full vantage of quantity production methods. The machinery is not nplicated and a large output may be made from a comparatively all plant. The imports of this class of material are actually much ger than those of plain rivets and since the consumption of these cial rivets and studs is much smaller the imports constitute a ly important fraction of the domestic total. In the case of plain ets, however, the imports are only negligible in quantity and are eeded many times by the exports.

[10] Scovill Manufacturing Co., Waterbury, Conn. [11] See especially the Iron Trade Review.

Total rivets, studs, and steel points—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	2 cents per pound	39,177	$5,430.00	$783.54	$0.139	14.43
1908	do	63,436	21,204.00	1,268.72	.342	5.98
1909	do	104,940	33,672.00	2,098.80	.321	6.23
1910	1½ cent per pound, 45 per cent ad valorem.		18,165.00	7,257.36		39.95
1911	do		9,742.00	3,872.70		39.75
1912	do		14,816.00	6,555.66		44.25
1913	do		10,110.00	4,368.55		43.21
1914	1½ cent per pound, 45 per cent ad valorem, 20 per cent ad valorem.		8,797.00	2,500.55		28.43
1915	20 per cent ad valorem.		4,215.00	843.00		20.00
1916	do		5,752.00	1,150.40		20.00
1917	do		10,830.00	2,166.00		20.00
1918	do		8,600.00	1,720.00		20.00
1919	do	112,136	7,632.00	1,526.40	.068	20.00
1920	do	61,789	6,594.00	1,318.80	.107	20.00
1921	do	30,175	2,534.00	500.80	.08	20.00

Rivets, studs, and steel points, lathed, machined, or brightened, and rivets or studs for nonskidding automobile tires—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	45 per cent		$15,424.00	$6,940.80		45.00
1911	do		7,908.00	3,558.60		45.00
1912	do		13,881.00	6,246.45		45.00
1913	do		8,179.00	3,680.55		45.00
1914 [2]	do		2,945.00	1,325.25		45.00
1914 [3]	20 per cent		5,520.00	1,104.00		20.00
1915	do		3,787.00	757.40		20.00
1916	do		8.00	1.60		20.00
1917	do					
1918	do		489.00	97.80		20.00
1919	do	28,169	1,984.00	396.80	$0.07	20.00
1920	do	34,555	2,595.00	519.00		20.00
1921	do	6,080	354.00	70.80	.06	20.00

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909, included with "other rivets" in prior year.
[2] July 1, to Oct. 3, 1913, under act of 1909.
[3] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Rivets of iron or steel, n. s. p. f.—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	2 cents per pound	39,177	$5,430.00	$783.54	$0.139	14.43
1908	do	63,436	21,204.00	1,268.72	.342	5.98
1909	do	104,940	33,672.00	2,098.80	.321	6.23
1910 [1]	do	7,402	2,168.00	148.04	.293	6.83
1910 [2]	1½ cents per pound,	13,479	573.00	168.52	.042	29.41
1911	do	25,126	1,834.00	314.10	.073	17.13
1912	do	24,736	935.00	309.21	.038	33.07
1913	do	55,038	1,931.00	688.00	.035	35.63
1914 [3]	do	1,064	42.00	13.30	.039	31.67
1914 [4]	20 per cent	4,553	290.00	58.00	.064	20.00
1915	do	5,222	428.00	85.60	.082	20.00
1916	do	132,953	5,744.00	1,148.80	.043	20.00
1917	do	387,327	10,830.00	2,166.00	.028	20.00
1918	do	50,295	8,111.00	1,622.20	.161	20.00
1919	do	83,967	5,648.00	1,129.60	.067	20.00
1920	do	27,234	3,999.00	799.80	.147	20.00
1921	do	24,095	2,150.00	430.00	.089	20.00

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.
[4] Oct 4, 1913, to June 30, 1914, under act of 1913.

Rivets, studs, and steel points—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rate of duty, specific and ad valorem.
1883	164	Iron or steel rivets, * * *.....	2½ cents per pound.
	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * copper, * * * or any other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1890	182	Rivets of iron or steel.....	2½ cents per pound.
	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of * * * copper * * * or any other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1894	153	Rivets of iron or steel.....	25 per cent ad valorem.
	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad valorem.
1897	167	Rivets of iron or steel.....	2 cents per pound.
	193	Articles or wares not specially provided for in this act, composed wholly or in part of * * * copper, * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1909	167	Rivets, studs, and steel points, lathed, machined, or brightened, and rivets or studs for nonskidding automobile tires.	Do.
		Rivets of iron or steel, not specially provided for in this section..	1¼ cents per pound.
	199	Articles or wares not specially provided for in this section, composed wholly or in part of * * * copper, * * * or other metal, and whether partly or wholly manufactured.	45 per cent ad valorem.
1913	138	Rivets, studs, and steel points, lathed, machined, or brightened, and rivets or studs for nonskidding automobile tires, and rivets of iron or steel, not specially provided for in this section.	20 per cent ad valorem.
1913	167	Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of * * * copper, * * * or other metal, * * * and whether partly or wholly manufactured.	Do.

Court and Treasury Decisions.

Ordinary steel rivets not adapted for use for nonskidding automobile tires are dutiable as rivets "not specially provided for." (Abstract 23661, T. D. 30768 of 1910.)

Drop-forged metal articles, invoiced as "gitterkugeln," consisting of balls of iron drilled or bored through the center, were held to come within the provision for rivets of iron in paragraph 167 of the act of 1897, but such articles invoiced as "gittenniette," made up of a short metal shaft on the top of which was a head either in the form of a ball or a pyramid, were held not to be rivets. Abstract 22001, T. D. 30069 of 1909.)

Small stud-like articles of steel invoiced as steel points were held to come within the provision for "wrought-iron or steel nails not specially provided for" in that act, (Abstract 21893, T. D. 30037 of 1909.)

Studs composed of bright steel about the size of the upper half of an ordinary pin, having star-shaped heads or head and pin in one, were declared not to be rivets, but dutiable as manufactures of metal under the act of 1890. (G. A. 928, T. D. 12015 of 1891.)

Ordinary rivets and high-grade articles are combined in paragraph 138 of the act of 1913 at the same rate of duty.

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UNITED STATES TARIFF COMMISSION
WASHINGTON

ARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 126 AND 127 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

CHAINS; PIPES AND TUBES; BOILERS AND TANKS

Paragraph 126:
Chains

Paragraph 127:
Pipes and Tubes
Boilers and Tanks

REVISED EDITION

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PREFACE.

This is one of a series of Tariff Information Surveys prepared by the nited States Tariff Commission and transmitted to the Committee n Ways and Means. The series covers all of the articles and com- odities provided for in the tariff act of October 3, 1913, and others ot specifically provided for. It is arranged in the numerical order f paragraphs of that act.

In some cases two or more paragraphs have been combined in one amphlet. In doing this, industrial relationship of the articles has een followed when possible. In those instances where a paragraph as been treated under a preceding paragraph of the tariff act, ference is made to this fact at the point where the paragraph ppears in numerical order. Where one grade of an article is dutiable nd another grade of the same article is on the free list, the article discussed under the dutiable paragraph, which appears first in umerical order in the tariff act. In certain instances articles of lose industrial relationship and which occur in separate paragraphs f the tariff act have been combined under one paragraph for con- enience of discussion. Reference is made to this fact at the point here the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and index," hich contains:

1. An introductory chapter discussing the scope of the series and e general method of treatment.
2. An alphabetical index of the articles provided for in the tariff t of 1913, showing the paragraph of the act in which the article is ovided for and, if discussed under a different paragraph, the number such paragraph.
3. A list of the pamphlets in the series, showing the paragraphs d articles included in each pamphlet.

Thus by use of this "Introduction and index," the exact location the discussion relating to a given article or commodity can be ertained.

In the preparation of this report the Tariff Commission had the rvices of H. J. Bierman and Walter Graham of the Metals Division the Commission's staff, and of others.

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CHAIN OR CHAINS OF IRON OR STEEL.

SUMMARY.

The investment in the chain industry in 1918 amounted to approxiately $5,000,000; the output was valued at about $10,000,000. is was exclusive of driving or sprocket chains for bicycles, autoobiles, etc., the production of which forms practically a separate dustry. The chain industry is located mainly in Connecticut, w York, Ohio, and Pennsylvania.

Imports have been relatively small, the greatest imports in any ar since 1907 having been in 1914, when they were 1,377,309 unds, valued at $158,659. In 1915 imports were considerably aller but the value was greater, $189,428. After 1915 imports clined sharply, and in 1918 (fiscal year) were only 154,719 pounds, lued at $15,823. Late in 1918 there was a very great increase in ports. In 1920 (calendar year) imports amounted to 511,177 unds, valued at $69,357.

Exports were not specified prior to 1918. In that year they were lued at $1,988,729, those exports going mainly to Canada, Japan, ba, Australia, and Italy. In 1919 (calendar year) they amounted $3,318,565. Before the war exports were small.

Chains are largely made by automatic machinery, only the heavier rieties being still commonly made by hand, and the trend is toward ge-scale production with greater investment in plant and equipnt. The chief raw material is iron or steel in bars or heavy wire. cause of those facts the chain industry is well suited to American ditions of production, and American producers probably will have le trouble in holding possession of the domestic market. With orable freight rates and trade agreements they should retain their thold in foreign markets.

Chain or chains of iron or steel—Summary table.

ar.	Domestic production.	Imports for consumption.[2]	Domestic exports.	Ratio to production.[3]		Value[4] (imports for consumption).	Amount of duty.	Value per unit of quantity.	Equivalent ad valorem rate.[5]
				Imports.	Exports.				
		Pounds.		*Per cent.*	*Per cent.*				*Per cent.*
...	.....	797,958	.....	.....	.....	$42,738.00	$20,880.08	$0.054	48.85
...	.....	1,146,598	.....	.....	.....	70,542.00	21,951.75	.062	47.50
...	.....	519,457	.....	.....	.....	34,019.00	15,849.53	.065	48.33
...	.....	650,102	.....	.....	.....	39,953.06	18,914.54	.061	47.34
...	.....	1,377,309	.....	.....	.....	158,658.50	37,599.82	.115	24.91
...	.....	870,480	.....	.....	.....	189,428.00	46,532.50	.217	24.56
...	.....	378,677	.....	.....	.....	70,240.00	17,253.20	.185	24.56
...	.....	309,045	.....	.....	.....	41,468.00	9,350.90	.134	22.54
...	$10,000,000	154,719	$1,988,729	0.16	19.89	15,823.00	3,399.65	.102	21.48
...	.....	679,889	.....	.....	.....	64,969.00	14,049.50	.096	21.63
ndar ar:									
18..	.....	647,164	1,940,000	.....	.....	57,699.00	12,377.55	.089	21.45
19..	.....	184,332	3,318,565	.....	.....	28,531.00	6,297.55	.155	22.07
20..	.....	511,177	.....	.....	.....	69,357.00	15,111.50	.136	21.79

Production, calendar years; imports and exports, fiscal years.
Including 344,410 pounds in 1911 and 8,813 pounds in 1912 on which duty was remitted and 218,057 nds in 1914 admitted free for construction, repair, or equipment of vessels.
Percentage based on values.
Including $24,132 in 1911 and $1,228 in 1912 on which the duty was remitted and $7,687 in 1914 admitted for construction, repair, or equipment of vessels.
Percentage reckoned on dutiable imports only.

OTE.—In addition to the imports tabulated there were others admitted free of duty as supplies for els or materials imported for the construction of vessels. These importations for 1918 (fiscal year) unted to 4,380,644 pounds, valued at $388,360; for 1918 (calendar year) to 5,728,118 pounds, valued at ,404; and for 1919 (calendar year) to 9,875,254 pounds, valued at $814,879.

General Information.

1913 TARIFF PARAGRAPH.

PAR. 126. Chain or chains of all kinds, made of iron or steel, not specially provided for in this section, 20 per cent ad valorem; sprocket and machine chains, 25 per cent ad valorem.

DESCRIPTION.

Structurally chains may be roughly divided into those whose links are each composed of a single piece of metal and those whose links are each made up of separate pieces of metal. The ordinary oval-link hoisting chain is an example of the first class, while the bicycle chain exemplifies the second class. It is common practice to define chains by special names based upon the form of the links, as stud chains, open-link chains and twisted-link chains; or upon the use to which they are put, as crane chain, chain cable, and bicycle chain. Names of other kinds of chain will be found in the classified list of manufacturers. Chains are also classified as weldless, fire welded, or electric welded, according to the process used in manufacture. (See paragraph on methods of production, below.)

A *stud chain* is one in each link of which a traverse stud or brace is placed to prevent the sides of the links from drawing together or closing up when subjected to a heavy pull or load. *Power-transmitting* chains may have links each composed of several pieces of metal connected by rivets, bolts, or stud screws, and so formed as to engage with the teeth of a sprocket wheel, as in the bicycle chain; or they may be made of malleable cast iron, each link a separate unit and so formed that one link can be slid sidewise to lock with the next one, but can not unlock in the position the links occupy in service. An example of the latter type is the drive chain on harvesters or binders. *Silent chains* are those in which each link is made up of several plates set edgewise and side by side, with profiles on the inner or driving side which fit the profiles of the oridnary spur-gear wheel. Such chains are used in driving the pump and valve-gear shafts in motor vehicles, and in transmitting power to the rear axles of such vehicles. Safety chains are composed of links stamped from a sheet of metal, each link having an eye at either end. The first link is bent double so that the eyes lie together; the next link is then threaded through the two eyes and bent to bring its eyes together, etc. Such chain is used in plumbing for securing washbowl stoppers, etc.

The strength of chains is a very important matter in certain uses, as, for example, chain cables of ships.[1]

The *size* of a chain is defined by the diameter of the bar of iron of which the links are made; thus a 1-inch chain is one whose links are made from bars 1 inch in diameter.

DOMESTIC PRODUCTION.

The investment in the chain industry in 1918 amounted to approximately $5,000,000 and the normal output is approximately $10,000,000.[2] This is exclusive of driving or sprocket chains for bicycles, automobiles, etc.

[1] The British Admiralty and corresponding organizations in other countries require all chain cables to undergo severe tests before it is used on shipboard.
[2] Statement of Mr. W. M. Taussig, sales manager of the American Chain Co.

Materials.—The chief raw materials are iron or steel bars and s, and of these the American manufacturers have an abundant estic supply. Some manufacturers of iron or steel chains also duce brass chains. For finishing or plating, asphaltum, benzine, s, zinc, copper, tin, nickel, and japans are used.

Methods of production.—Chains for cranes, ships' cables, dredges, and generally speaking, all chains over one inch in size are ely made by hand. The workman, taking a round bar of iron he proper diameter, heats it in a forge and then with a chisel off a piece long enough to form a single link. This piece is n heated and then bent by hammer blows around a suitably ed nose until it has a U shape. The U-shaped piece is then ted into the last completed link and the unconnected ends st into the forge to receive a welding heat. The final process weld together the unconnected ends and to bring the link to ect form and dimensions. Although this laborious hand process till largely used, it is giving way gradually to semi automatic hine processes.

Machine-made iron chains are of two kinds, known as welded n or weldless chain. In making welded chains by machine the of iron is first run through a machine called a winder, which ds it round a mandrel and turns it out in the form of a long al spring. This rod is then cut by a machine so that each twist piral is severed from the next and the stock is in the form of s whose open ends need only to be welded together to form com- e closed links. The welding is done by heating the ring and ing it in dies which, under the blows of a trip hammer, form it shape and weld together the open ends.

Weldless machine-made chains are manufactured by automatic hinery which takes the rolled iron, cuts it into links and connects links into completed chains. In weldless chains the links are ned by twisting or locking the unconnected ends of the short ths of rods or wire. Weldless chains are made only in the small s, which are used for horse halters, cow ties, dog chains, etc.

In making bicycle chains and other chains for transmitting power link of which is made of several pieces of metal, the separate s are cut, stamped, turned, threaded or otherwise formed by hinery, but are assembled by hand.

The use of automatic machinery and the electric-welding process h are increasing even in the manufacture of heavy chains, ce the labor cost in production. But they involve greater stment in plant and consequently increase overhead charges and vances for depreciation and obsolescence. Under the hand-wel- methods in the past, investment in plant was comparatively ll and chain plants might be established almost over night when r, fuel, and material were available.

Organization.—The present tendency in the chain industry is ard combination of firms, larger plants, and greater invest- t in equipment—manufacture by hand giving way to manufac- by automatic machinery. The total investment in the chain stry in the United States in 1918 was approximately $5,000,000, led among some 15 corporations—this being exclusive of driving procket chains for bicycles.[3] In 1913 John C. Schmidt, of the

[3] Statement of W. M. Taussig, American Chain Co.

Standard Chain Co. of Pittsburgh, estimated that $4,000,000 invested in the chain industry. The output he estimated $6,500,000. The number of firms was 31. Both in The Register of American Manufacturers and in the Roster Hardw Manufacturers' Organization for War Service, a larger numbe establishments is listed, but in both cases the list includes f which are not engaged primarily in manufacturing chains.

Manufacturers of chains may be divided into four classes, accor to the type of chain they produce, as follows:

(1) Manufacturers of proof coil [1], ships' cable, and strength c of sizes $\frac{5}{8}$ inch in diameter or over.

(2) Manufacturers of lighter chain where great strength is required, as dog chains, trace chains, and chains used by ma facturers.

(3) Lighter chains of all kinds where little strength is requi

(4) Manufacturers of driving or sprocket chains for bicy automobiles, machinery, etc.

Only a few plants produce more than two classes of chains enum ated above and none produce all four classes. Class (4) is in fact industry quite separate from the general chain industry. Many the corporations manufacturing chain also produce other artic as drop forgings, saddlery hardware, etc.

Geographical distribution.—In the Roster of the Hardware Ma facturers' Organization for War Service (1918) 58 chain manu turing establishments are listed, including a number of firms primarily engaged in the production of chains. Of the 58 fi listed, 13 were in Connecticut, 11 in New York, 7 in Ohio, 6 Pennsylvania, 4 in Indiana, and 3 in Wisconsin. There were one two each in Massachusetts, Michigan, Missouri, Illinois, West V ginia, Florida, Tennessee, and Washington.

Domestic production and consumption.—The domestic output chain was estimated by a manufacturer in 1918 at $10,000,0 exclusive of driving and sprocket chains, but including certain o products manufactured in chain-making establishments.

In comparison total imports of iron or steel chain have been sm The greatest imports in any year since 1907 were in 1915, w they were valued at $189,428; the smallest in 1918, valued $15,823. Prior to 1914 imports of chain were not classified acc ing to kind, but according to size or whether or not paying a spe duty equivalent to 45 per cent ad valorem. Since 1914 imp have been classified, in accordance with the act of 1913, as spro or machine chain, and all others. From 1914 to 1917, inclu imports consisted predominantly of sprocket or machine ch Imports of that class in 1915 were 575,505 pounds, valued $172,938. In 1918, however, imports of this class were only 9 pounds, valued at $4,701.

Domestic exports.—Domestic exports of chains are not spec prior to 1918. In 1918 exports were valued at $1,988,729, of w $545,030 went to Canada, $288,672 to Japan, $184,587 to C $113,647 to Australia, and $111,511 to Italy. Exports are sh on page 16 for all countries, exports to each of which amounte more than $40,000 in 1918.

[1] Proof coil is ordinary coil link welded chain, proof-tested to strains for the various sizes.

FOREIGN PRODUCTION.

Germany, England, and France are leading foreign producers. t chains are also produced in Sweden, Belgium, Russia, Spain, d other countries.

In the Westphalia chain-making district in Germany and in the dley Heath district in England[5] part of the output is produced hand by outworkers who obtain the iron and coke necessary m their employers, work up the chain in their own little shops, return the completed article to their employers. In Germany 912 no women were employed at the forges and the outworkers d in tolerable comfort in their own cottages.

ussia had in 1916 an important hand chain-making industry r Nizhni Novgorod. Chains were also forged at Kolpinsk near rograd and Votkinsk in the Urals.[6]

n Norway, in 1918, a project was under way to begin the manu- ure of anchor chains by machinery by means of a new invention ch would enable them to be made as well by machinery as by d. Before that date, Norway imported hand-made anchor chains n England.[7]

hain production in Spain covers only about 75 per cent of domestic sumption. Belgium exported chain before the war.

IMPORTS.

mports in 1907 were 1,193,141 pounds, valued at $70,894. From 7 to 1910 they decreased, amounting in 1910 to 797,958 pounds, ued at $42,738. In 1911, they increased in quantity and value to proximately the 1907 level, but declined again in 1912 and 1913 ow the 1910 level. Dutiable imports were greatest in quantity in 4, when they amounted to 1,377,309 pounds, valued at $158,658, l greatest in value the following year, when the quantity was ,480 pounds, valued at $189,428. From 1915 to 1918 (fiscal years) re was a marked decline in the imported chains subject to duty. te in 1918 (calendar year) there was a great increase in dutiable ports followed by a decline in 1919, and an increase in 1920, when y amounted to 511,177 pounds, valued at $69,357.

n addition to these imports there were others of comparatively ge amounts which came into the country free of duty, as supplies vessels or materials for the construction of vessels, as articles cially imported under the provision of Section IV of the act of 3. In the fiscal year 1918 these imports amounted to 4,380,644 nds, valued at $388,360, and in the calendar year 1919 they aggre- ed 9,875,254 pounds, valued at $814,879. These comparatively ge importations were due to the stimulus given by the war to the p-building industry in the United States.

The imports of chains, both dutiable and free, are less than exports, l form a small fraction of the country's total consumption.

PRICES.

omparable statistics of prices of chains in the United States and ign countries are not available. In the table of prices, however, be found wholesale prices of various sizes of American coil straight-

detailed report on the English chain industry based on field investigations by the commission's entative may be found in the files of the Tariff Commission.
ssian Markets for American Hardware, Department of Commerce, Misc. Series, No. 46, p. 13.
mmerce Report, Feb. 11, 1918, p. 553.

link chain as quoted in the Hardware Age. Prices of all s creased greatly from January, 1913, to January, 1919, but the i was proportionately greater for the heavier sizes. During t year period the price of three-sixteenth inch chain, for examp from $7.85 per 100 pounds to $20.25, an increase of 158 per cen the price of 1 to 1¼ inch chain rose from $2.95 per 100 po $15.25, an increase of 417 per cent. Prices of all decreased to a extent during 1919.

TARIFF HISTORY.

By the act of 1894 chains of iron and steel of all kinds wer dutiable at 30 per cent ad valorem. By the act of 1897 a specif was substituted for the ad valorem rate, the new duty rangin 1½ cents per pound on chain not less than three-fourths of an diameter to 3 cents per pound on chain less than five-sixtee an inch in diameter. It was further provided that no chain or steel should pay a lower rate of duty than 45 per cent ad va Imports the last three years, during which this act was in ranged from 1,193,141 pounds, valued at $70,894 in 1907, do 700,672 pounds, valued at $45,639 in 1909. The duty collected aged during those three years approximately $28,000, equival about 48 per cent ad valorem.

The act of 1909 retained the classification of 1897, but reduc specific rates slightly, fixing them at seven-eighths of 1 ce pound to 3 cents per pound. The provision that no chain of i steel should pay a lower rate of duty than 45 per cent was ret Imports under this act ranged from a maximum of 1,146,598 p valued at $70,542, in 1911, down to 519,457 pounds, valu $34,019, in 1912. On 344,410 pounds imported in 1911 the dut remitted under the provision relating to construction, equipme repair of vessels. The average computed ad valorem rate on du imports for the three years 1911–1913 under the act of 190 approximately 47.5 per cent, or only ½ per cent below the av rate under the old law.

The act of 1913 substituted for the old specific duties an ad va duty of 25 per cent on sprocket and machine chain and an ad va duty of 20 per cent on all other chain of iron or steel. Thus the age rate of duty was reduced by more than half. In the fisca 1914, during the last nine months of which the low duty was in imports increased to 1,377,309 pounds, valued at $158,659, an in in quantity of more than 100 per cent over 1913, and in va nearly 300 per cent. Of the imports in 1914, 218,057 pounds, v at $7,687, were admitted free for the construction, equipme repair of vessels. After 1914 the quantity of imports dec steadily, but this is to be attributed to the effects of the war on pean industries.

COMPETITIVE CONDITIONS.

Chains are largely made by automatic or semiautomati chinery. Even in the production of heavy chains, machinery ginning to displace hand labor. Raw materials play an imp part in costs of production. The chief raw material is iron or s the form of bars or heavy wire, although some chains are m brass. For finishing or plating brass, copper, zinc, tin, nick phalt, benzine, and japan are used. The chain industry is which the trend is toward large scale production, with combina formerly independent plants and larger investment in plan

ent. It is therefore an industry well suited to American con- of production and American producers should be able to meet competition successfully. The domestic industry is now well hed, imports are relatively small, and a large export trade has veloped. Prior to 1918 no export statistics are available but hat date American chains had appeared in the world market petition with the chains of European producers. However, before 1914 were purely nominal, and in that year imports d substantially when the low tariff of 20 to 25 per cent went ect. The chief advantages of England and Germany in the field before the war were low freight rates. Germany under- gland, France, and Belgium, but put out an inferior product. vorable freight rates, American producers should be able to place in the export field.

TARIFF CONSIDERATIONS.

facturers alleged in 1913 that sprocket chains should properly ified separately at a higher rate than iron or steel cable or coil Sprocket chains, they said, are made from accurately ma- parts and contain in their costs a small percentage, 14 per cent er cent, in material, and a large percentage in skilled labor, the costs of cable or coil chains were more largely made up of ls and unskilled labor. The act of 1913 did make such a ation, imposing a duty of 25 per cent on sprocket and machine against 20 per cent on all other chain.

Chain or chains of iron or steel—Production in United States.

	[1] $6,500,000
	[2] 10,000,000

of John C. Schmidt, of the Standard Chain Co., Pittsburgh, Pa., tariff hearings by the Com- Ways and Means, 1913.
nt of W. M. Taussig, of the American Chain Co., to the United States Tariff Commission; lude driving or sprocket chains.

d chain cables—Production in principal foreign countries, for the year 1906.

[From Census of Production, United Kingdom, 1907.]

gdom:	Value.
elded	$2,856,636
made	189,793
	3,046,429

in or chains of iron or steel—Total imports for consumption—Revenue.

ar—	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent*
	Various specific	1,193,141	$70,894.04	$34,882.27	$0.059	49.20
	do	786,903	56,276.00	26,376.60	.072	46.87
	do	700,672	45,639.00	21,780.42	.065	47.72
	do	797,958	42,738.00	20,880.08	.054	48.85
	do	802,188	46,410.00	21,951.75	.058	47.30
	D. R., sec. 19	344,410	24,132.00		.071	
	do	8,813	1,228.00		.139	
	Various specific	510,644	32,791.00	15,849.53	.064	48.33
	do	650,102	39,953.06	18,914.54	.061	47.34
	Free, sec. IV, J 5	218,057	7,687.00		.035	
	Various ad valorem.	1,159,252	150,971.50	37,599.82	.130	24.91
	do	870,480	189,428.00	46,532.50	.217	24.56
	do	378,677	76,240.00	17,253.20	.185	24.56
	do	309,045	41,468.00	9,350.90	.134	22.54
	do	154,719	15,823.00	3,399.65	.102	21.48
	do	679,889	64,960.00	14,049.50	.096	21.63
ar—						
	do	647,164	57,099.00	12,377.55	.089	21.45
	do	184,332	28,531.00	6,297.55	.155	22.07
	do	511,177	69,357.00	15,111.50	.136	21.79

Chain or chains of iron or steel, not less than three-fourths inch in diameter—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1½ cents per pound.	48,771	$629.00	$548.68	$0.013	87.21
1908	do	335	22.00	3.77	.066	17.14
1909	do	600	58.00	6.75	.097	11.63
1910	do					
1911	D. R.	121,674	6,875.00		.057	
1912	do	8,813	1,228.00		.139	
1913						
1914	⅛ cent per pound	170	3.31	1.49	.019	45.02

Chain or chains of iron or steel, less than three-fourths inch and not less than three-eighths inch in diameter—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1½ cents per pound.	2,858	$131.00	$39.30	$0.046	30.00
1908	do	9,007	431.00	123.84	.048	28.73
1909	do	314	3.00	4.32	.01	144.00
1910 [1]	do	6,453	170.00	88.73	.026	52.20
1910 [2]	1¼ cents per pound.	33,216	203.60	373.68	.006	183.53
1911	do	10,788	542.00	121.87	.050	22.39
1912	do	6,212	155.00	69.89	.025	45.09
1913	do	1,372	34.06	15.44	.025	45.33

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.

Chain or chains of iron or steel, less than three-eighths inch and not less than five-sixteenths inch in diameter—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	1¾ cents per pound.	660	$26.00	$12.37	$0.039	47.39
1908	do	11,692	670.00	219.22	.057	32.72
1911	1¼ cents per pound.	563	19.00	9.85	.034	51.79

Chain or chains of iron or steel, less than five-sixteenths inch in diameter—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	3 cents per pound.	373,530	$18,828.00	$11,205.90	$0.05	59.52
1908	do	186,809	9,763.00	5,604.27	.052	57.40
1909	do	198,155	10,412.00	5,944.65	.053	57.09
1910	do	188,334	9,548.00	5,650.02	.051	59.17
1911	do	252,436	14,188.00	7,573.08	.056	53.39
1912	do	190,318	10,258.00	5,709.54	.054	55.66
1913	do	145,605	7,628.00	4,368.15	.052	57.27
1914	do	9,550	476.69	286.50	.05	60.10

Chain or chains of iron or steel; other on which specific duty does not amount to 45 per cent—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	45 per cent	767,322	$51,280.04	$23,076.02	$0.067	45.00
1908	do	579,060	45,390.00	20,425.50	.078	45.00
1909	do	501,603	35,166.00	15,824.70	.070	45.00
1910	do	569,955	32,817.00	14,767.65	.058	45.00
1911[1]	D. R.	222,736	17,257.00		.077	
1911	45 per cent	538,401	31,661.00	14,247.45	.059	45.00
1912	do	314,114	22,378.00	10,070.10	.071	45.00
1913	do	503,125	32,291.00	14,530.95	.064	45.00
1914	do	58,181	5,449.00	2,452.05	.093	45.00

[1] Sec. 19, act of Aug. 5, 1909.

Chain or chains of iron or steel, sprocket and machine chains—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year—		*Pounds.*				*Per cent.*
1914	25 per cent	603,279	$117,025.50	$29,256.38	$0.194	25.00
1915	do	575,505	172,938.00	43,234.50	.300	25.00
1916	do	221,714	64,104.00	16,026.00	.289	25.00
1917	do	86,388	22,746.00	5,686.50	.263	25.00
1918	do	9,908	4,701.00	1,175.25	.474	25.00
1919	do	162,339	21,158.00	5,289.50	.130	25.00
Calendar year—						
1918	do	129,237	16,763.00	4,190.75	.130	25.00
1919	do	42,447	11,827.00	2,956.75	.279	25.00
1920	do	61,774	24,802.00	6,200.50	.401	25.00

Chains of iron or steel: All other—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year—		*Pounds.*				*Per cent.*
1914	Free, sec. IV.[1]	218,057	$7,687		$0.035	
1914	20 per cent	488,072	28,017	$5,603.40	.057	20.00
1915	do	294,975	16,490	3,298.00	.056	20.00
1916	do	156,963	6,136	1,227.20	.038	20.00
1917	do	191,546	16,722	3,344.40	.087	20.00
1918	do	144,811	11,122	2,224.40	.077	20.00
1919	do	517,550	43,802	8,760.00	.085	20.00
Calendar year—						
1918	do	517,916	40,926	8,185.20	.079	20.00
1918	20 per cent-20 per cent.[2]	11	10	1.60	.909	16.00
1919	20 per cent	141,885	16,704	3,340.80	.118	20.00
1920	do	449,403	44,555	8,911.00	.099	20.00

[1] For construction, equipment, or repair of vessels. [2] Reciprocity treaty with Cuba.

Chains of iron or steel: Under reciprocity with Cuba—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1917	20 per cent-20 per cent.	31,111	$2,000	$320	$0.064	16.00

Chains of iron or steel—Domestic exports.

Exported to—	Fiscal year 1918.[1]	Calendar year.	
		1918	1919
France	864,759	$151,268	[illegible]
Italy	111,511	119,953	[illegible]
Russia in Europe	64,822	.....	.....
England	42,596	16,010	[illegible]
Canada	545,080	472,177	[illegible]
Mexico	91,035	126,221	[illegible]
Cuba	184,587	143,474	[illegible]
Brazil	40,698	16,291	[illegible]
Dutch East Indies	42,515	36,008	[illegible]
Japan	288,672	273,035	[illegible]
Australia	113,647	121,315	[illegible]
Philippine Islands	51,718	71,997	[illegible]
Argentina	.....	23,483	[illegible]
Chile	.....	29,283	[illegible]
China	.....	52,598	[illegible]
British South Africa	.....	19,353	[illegible]
All other	347,139	267,396	[illegible]
Total	1,988,729	1,940,000	[illegible]

[1] Not specified prior to 1918.

Chain: Proof coil, American coil—Prices, wholesale, straight link, per 100 pounds, small lots, New York or Pittsburgh.

[From Hardware Age.[1] Prices revised to dates given below.]

Size.	1913		1914		1915	1916	
	Jan. 9.	July 10.	Jan. 9.	July 9.	Jan. 14.	Jan. 6.	July 5.
¼ inch	$7.85	$8.10	$8.10	$8.10	$8.10	$8.35	[illegible]
⅜ inch	5.30	5.55	5.55	5.55	5.55	5.80	[illegible]
½ inch	3.75	4.00	4.00	4.00	4.00	4.25	[illegible]
⅝ to ⅞ inch	3.40	3.65	3.65	3.65	3.65	3.95	[illegible]
¾ inch	3.25	3.50	3.50	3.50	3.50	3.55	[illegible]
⅞ inch	3.15	3.40	3.40	3.40	3.40	3.75	[illegible]
1 to 1¼ inches	2.95	3.20	3.20	3.20	3.20	3.55 3.65	[illegible]

Size.	1917		1918		1919		
	Jan. 9.	July 6.	Jan. 3.	July 4.	Jan. 16.	July 3.	Dec. 31.
¼ inch	$10.60	$12.10	$14.10	$19.00	$20.25	$15.00	[illegible]
⅜ inch	7.00	9.55	11.55	14.50	18.25	14.00	[illegible]
½ inch	6.50	8.00	10.00	10.00	16.00	10.00	[illegible]
⅝ to ⅞ inch	7.35	7.70	9.70	9.70	15.55	9.50	[illegible]
¾ inch	7.50	7.60	9.60	9.50	15.45	9.25	[illegible]
⅞ inch	7.40	.....	9.50	9.40	15.35	9.00	[illegible]
1 to 1¼ inches	7.40 7.50	.....	9.30 9.40	9.20	15.25	8.50	[illegible]

[1] "Current Hardware Prices" department: Quotations represent prices obtainable by the fair retail hardware trade. Other chain prices may be found in the same reference. The price quotations are revised from month to month.

Chain or chains of iron or steel—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	171	Chain or chains of all kinds, made of iron or steel:	
		Not less than three-fourths of 1 inch in diameter	1¾ cents per pound.
		Less than three-fourths of 1 inch and not less than three-eighths of 1 inch in diameter.	2 cents per pound.
		Less than three-eighths of 1 inch in diameter	2½ cents per pound.
1890	164	Chain or chains of all kinds, made of iron or steel:	
		Not less than three-fourths of 1 inch in diameter	1 9/10 cents per pound.
		Less than three-fourths of 1 inch and not less than three-eighths of 1 inch in diameter.	1 9/10 cents per pound.
		Less than three-eighths of 1 inch in diameter	2½ cents per pound.
		But no chain or chains of any description shall pay a lower rate of duty than 45 per cent ad valorem.	
1894	137	Chains of all kinds, made of iron or steel	30 per cent ad valorem.
1897	151	Chain or chains of all kinds, made of iron or steel:	
		Not less than three-fourths of 1 inch in diameter	1½ cents per pound.
		Less than three-fourths of 1 inch and not less than three-eighths of 1 inch in diameter.	1⅝ cents per pound.
		Less than three-eighths of 1 inch in diameter and not less than five-sixteenths of 1 inch in diameter.	1¼ cents per pound.
		Less than five-sixteenths of 1 inch in diameter	3 cents per pound.
		But no chain or chains of any description shall pay a lower rate of duty than 45 per cent ad valorem.	
1909	150	Chain or chains of all kinds, made of iron or steel:	
		Not less than three-fourths of 1 inch in diameter	Seven-eighths of 1 cent per pound.
		Less than three-fourths of 1 inch and not less than three-eighths of 1 inch in diameter.	1½ cents per pound.
		Less than three-eighths of 1 inch in diameter and not less than five-sixteenths of 1 inch in diameter.	1¼ cents per pound.
		Less than five-sixteenths of 1 inch in diameter	3 cents per pound.
		But no chain or chains of any description shall pay a lower rate of duty than 45 per cent ad valorem.	
1913	126	Chain or chains of all kinds, made of iron or steel:	
		Not specially provided for in this section	20 per cent ad valorem
		Sprocket and machine chains	25 per cent ad valorem.

Chain or chains of iron and steel—Duties in foreign countries.[1]

CANADA.

Tariff No.	Description.	Tariff rates.		
		British preferential.	Intermediate.	General.
410	Coil chain, coil chain links, and chain shackles of iron or steel, 1½ inches in diameter and over.	5 per cent.	12½ per cent	12½ per cent.
410a	Coil chain, coil chain links, including repair links, and chain shackles of iron or steel, n. s. p. f.	20 per cent.	27½ per cent	27½ per cent.
411	Malleable sprocket or link-belting chains of steel, when imported by manufactures of agricultural implements for use in the manufacture of such implements in their own factories.	5 per cent.	7½ per cent	7½ per cent.
470	Cable chains	Free	Free	Free.

FRANCE.

Tariff No.	Description.	Tariff rates.	
		General.	Conventional.
562b	Chains of iron or steel with links:		
	15 millimeters (0.59 inch) or more in thickness—		
	Per 100 kilograms, net	12 francs	8 francs.
	Per pound in United States currency	$0.015	$0.01.
	8 millimeters or less in thickness—		
	Per 100 kilograms, net	24 francs	15 francs.
	Per pound in United States currency	$0.02	$0.013.

[1] Kelly's Custom's Tariffs of the World, 1918.

Chain or chains of iron and steel—Duties in foreign countries—Continued.

GERMANY.

Tariff No.	Description.	Tariff rates. General.	Conventional
829	Chains (except bicycle chains) and parts thereof):		
	Rough, for towing—		
	Per 100 kilograms, net	3 marks	1.50 ma
	Per pound in United States currency	$0.0032	$0.001
	Rough, other—		
	Per 100 kilograms, net	6 marks	5 mark
	Per pound in United States currency	$0.0064	$0.005
	Worked—		
	Per 100 kilograms, net	15 marks	
	Per pound in United States currency	$0.016	

JAPAN.

566(3)	Bicycle chains:		
	Per 100 kin	31.40 yen	
	Per pound in United States currency	$0.1184	
	Gearing chains of iron	25 per cent ad valorem.	
	Other iron chains, each not exceeding 500 grams (1.1 lb.) in weight	30 per cent ad valorem	
	Other iron chains:		
	Per 100 kin	2 yen	
	Per pound in United States currency	$0.0075	
490	Chain belting for machinery	20 per cent ad valorem.	

SWEDEN.

784	So-called ewarts chains, with loose links belonging thereto:		
	Per 100 kilograms	12 krona	
	Per pound in United States currency	$0.0146	
	Other kinds, the iron in the links having a diameter of:		
785	25 millimeters (0.98 inch) or more—		
	Per 100 kilograms	5 krona	
	Per pound in United States currency	$0.0061	
786	From 6 millimeters (0.24 inch), inclusive, to 25 millimeters—		
	Per 100 kilograms	8 krona	
	Per pound in United States currency	$0.0098	
787	Less than 6 millimeters; also link bolt chains (galls)—		
	Per 100 kilograms	10 krona	
	Per pound in United States currency	$0.0122	

WROUGHT PIPES AND TUBES OF IRON AND STEEL.

SUMMARY.

The United States stands first among the nations of the world in the production of wrought-iron and steel pipes and tubes.

In 1919 the total domestic production amounted to 2,572,300 gross tons, the estimated value being about $500,000,000, most of which was the output of factories in Pennsylvania and Ohio.

Competition in the domestic market from foreign sources is negligible; this being evidenced by the annual imports, which amounted in the fiscal year 1919 to only 309 gross tons. Most of the foreign product entering this country at the present time (1921) comes from Great Britain, whereas before the World War Germany was the chief source. The lack of foreign competition in America is due largely to the threads of foreign-made pipe being of a different standard than the pipe threads in general use in the United States, which prohibits the making of a perfect joint between American and foreign standard pipe; to the greater cost of manufacturing pipe with the foreign-style thread, and to the highly developed state of manufacture in this country. Furthermore, the American industry is amply equipped to satisfy the most extravagant demands that may be made upon it.

American production is somewhat larger than the domestic consumption, the excess finding an outlet in foreign markets in all parts of the world. The product is sold in foreign countries chiefly in competition with the products of Great Britain and Germany.

The annual export trade of the United States is fully as large as that of its foreign competitors, a further indication that the American manufacturer is at no particular disadvantage in selling to foreign markets.

Wrought pipes and tubes of iron and steel—Summary table.

Fiscal year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Value (imports for consumption).[3]	Amount of duty.	Equivalent ad valorem rate.
	Gross tons.	*Gross tons.*	*Gross tons.*			*Per cent.*
1910	.....	181	.....	$164,686	$51,300	31.15
1911	.....	302	.....	166,458	50,625	30.41
1912	.....	98	.....	161,240	48,041	29.80
1913	2,354,099	2,092	.....	542,051	164,189	30.29
1914	1,828,299	1,354	.....	432,747	102,082	23.54
1915	2,059,342	111	[4] 117,695	147,086	28,207	19.18
1916	2,841,531	520	125,628	42,387	7,257	17.12
1917	2,713,652	528	168,911	82,944	15,876	19.14
1918	2,583,373	761	102,130	154,575	29,327	18.98
1919	2,572,300	309	236,080	35,926	7,185	20.00
1920[5]	.....	308	.....	62,639	12,527	20.00

[1] Calendar year.
[2] Includes furnaces and cylindrical tubes, but does not include finished tubes for earlier years, beginning with 1919 finished tubes are included in the totals.
[3] Figures include fittings, but do not include boiler tubes, as data of quantities are not available.
[4] Figures prior to 1915 include cast-iron pipe.
[5] Includes furnaces and cylindrical tubes, but does not include cast-iron pipe.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

127. Lapwelded, butt-welded, seamed, or jointed iron or steel tubes, pipes, flues, or stays; * * * and all other iron or steel tubes, finished, not specially provided for in this section, 20 per cent ad valorem.

DESCRIPTION.

NOTE.—Descriptive and other data on pipes and tubes of material other than iron or steel are given in other surveys of the commission. Thus, copper pipe is treated in Tariff Information Surveys on Rolling-mill Products, and Rolling-mill and Wire Products; lead pipe in Lead Manufactures, and cast-iron pipe in Iron Castings.

Iron and steel tubes or pipes are long hollow metallic cylinders made in a number of different ways for certain general uses, usually designated from the way in which they are manufactured. Mechanically there is no distinction between a pipe and a tube; but in use the two words are often somewhat arbitrarily distinguished. Thus when the form of the thing is chiefly considered, "tube" is regularly used, as, a lapwelded tube, seamless tube, etc.; so, also, with reference to certain mechanical uses one word or the other is exclusively used, as gas pipe, drainpipe, etc. Flues are pipes or tubes for conveying heat to water in certain kinds of steam boilers. Stays are pipes expanded or fastened to plates composing the shell or boilers for bracing purposes.

The following kinds are commonly known commercially:

Welded and riveted pipes.—These are made from plates of steel or wrought iron called "skelp," which are rolled up longitudinally into shape and welded or riveted together. Riveted pipes are generally of diameters larger than 30 inches, and are used for hydraulic purposes.

Bed tubing is butted, not welded; the longitudinal edges of the skelp are brought together but not joined.

Lapwelded pipe.—So named because the edges of the pipe are lapped before being welded. Lapwelded pipe is superior to butt-welded pipe, because it is less likely to be defective in the weld.

Butt-welded pipe has the edges of the skelp welded together without lapping, and the size is generally restricted to a maximum diameter of 3 inches.

Spirally welded or riveted pipe is made up of skelp strips or sheets bent into form spirally.

Seamless tubing has no longitudinal joint and is therefore considered safer for high-pressure purposes.

Galvanized-iron pipe is ordinary iron or steel pipe coated with zinc.

Corrugated pipe is bent or drawn into parallel furrows or ridges to resist collapsing pressure.

Structural pipe ordinarily is pipe rejected as defective for high pressure, and other scrap pipe.

Unions and couplers are short lengths of pipe with interior threads to fit the ends of pipe to be joined together.

Oil-well casing is steel tubing of large size. It is thinner in proportion to its diameter than ordinary tubing, and is equipped with

reams and couplings; the quality is somewhat better and it costs more than ordinary heavy tubing of equal diameter.

Special tubes of high quality and tubes for particular uses are made of charcoal iron and of alloy steel. Iron and steel pipe is made acid proof by lining with copper, lead, or tin.

Uses.—Some of the principal uses of iron and steel pipe are for steam, gas, oil, and water conduits, boiler tubes, bent coils, radiators, and structural purposes. A large proportion of pipe manufactured is used in plumbing and heating contracts.

Seamless tubing is used in boilers by the United States Navy exclusively, and it is superseding lap-welded pipe for other high-pressure uses. Cold-drawn tubes from ⅜ to 1½ inches outside diameter are generally known as bicycle tubing; 1 to 4 inches diameter are used for boilers; other sizes are used for bushings, hollow shafts, spindles, axles, collars, rings, ferrules, pumps, barrels, etc. The effect of cold drawing is to obtain accuracy of dimensions, and better surface and physical qualities.

Competing articles.—The principal substitutes for wrought iron and steel pipes and tubes are cast-iron pipe and brass tubing. Both of these are more costly than iron and steel pipes, although they withstand corrosion better and do not rust.

DOMESTIC PRODUCTION.

In 1919 the total production of all kinds of iron and steel pipes and tubes, other than cast iron, amounted to 2,572,300 gross tons, which is slightly in excess of the production in 1913. [Production tables, infra.]

Of the total 1919 production 2,409,944 tons, or 94 per cent, were made of steel, and only 162,356 tons, or 6 per cent, were made of iron.

Although seamless tubes form only a small part of the total tube production, their importance is increasing annually, the 1919 production (197,369 gross tons) being almost double the production in 1913 (108,567 gross tons). Compared to the total tube production, seamless tubes formed less than 5 per cent in 1913, while in 1919 they formed almost 8 per cent.

The total value of the domestic output can be estimated, only approximately, at a little less than $500,000,000 for the year 1919. Seamless tubes were valued at about $49,000,000, computed at an average price of a little over $250 a ton. The cost of making welded pipe is about double the cost of skelp.[1] In January, 1919, the price of sheared skelp averaged $67.20 a gross ton; the manufacturer's profit on finished tubes is approximately $5 a ton. Computed on these bases the total value of welded pipes and tubes produced in 1918 would be about $319,000,000.

Materials.—Seamless pipe is made from carbon steel or alloy steel billets; welded pipe from iron or steel plate, and from charcoal iron or wrought iron or from steel skelp. It takes 2,576 pounds of steel skelp to make a ton (2,240 pounds) of pipe, the waste being cinder, scale, crop ends, and other scrap.[2] The fibrous structure

[1] Mark Manufacturing Co., Tariff Hearings, 1913. H. Doc. No. 1447, p. 1358.
[2] J. A. Campbell, Tariff Hearings, 1909. H. Doc. No. 1504, p. 2439.

and purity of charcoal iron skelp makes it far superior to steel for boiler pipes, flues, and stays. It is made from domestic wrought iron or imported Swedish iron, costs more to manufacture than steel skelp, and commands a higher price.

Domestic raw materials are used almost exclusively, although before the war a certain amount of Swedish iron was imported. On foreign materials the import duty on iron and steel plates and skelp is 12 per cent ad valorem, whereas steel billets are duty free.

Equipment.—The modern manufacture of iron and steel pipes and tubes requires the use of furnaces, rolling mills, power hammers, chopping shears, scarvers, mandrels, and slitting, riveting, welding, cutting, bending, and drawing machines, and other equipment. All of the requisite equipment is of domestic manufacture and American machinery is also used to some extent by manufacturers in foreign countries. In 1913 it was stated that 13 mills in Germany, Scotland, Austria, Russia, and Italy were equipped throughout with American machinery.[3]

A mill consisting of one lap-weld and two bell-weld furnaces, equipped with modern machinery and adequate socket and warehouse capacity, including land, railroad tracks, boilers, electric light and power plant, machine shop, foundry, etc., has a capacity of about 54,000 gross tons a year, and an annual output of about 40,000 tons. Such a plant in 1909 was stated to cost about $1,250,000, and would last about 20 years. On this basis the depreciation was computed at $1.56 per ton of output.[4]

Methods of production.—Lap-welded tubing: The wrought iron or steel low in carbon is first rolled into skelp, which has its edges beveled (scarfed). The skelp is about 20 to 25 feet long, its width is a little more than three times the intended diameter of the tube. If large, it is then rolled into the rough form of a pipe by passing it sideways through the rolls, which bend it roughly to the shape of a pipe with edges overlapping. The same result is obtained with 2 to 8 inch tubes, by drawing the skelp through a die. It is then passed at a welding heat through a pair of rolls, with the seam that is to be welded upward. Between the rolls is a mandril on the end of a long rod and of the size of the inner diameter of the tube. The rolls press the two parts of the weld together over the mandril, and the pipe, after another rolling to give the true size and after straightening and testing, is ready for service. It is made up to 30 inches in diameter.

Seamless tubes: Seamless or weldless tubes are made either by cupping a steel plate between dies, or else by piercing a hole through the center of a hot steel billet and then rolling it successively between rolls over a mandril. By the latter method a small hole is made which is later expanded by pressing larger and larger expanders through it. The pierced billet is then rolled over mandrils constantly decreasing in size until the inner and outer diameters are brought to the desired size. Heat treatment of tubes is required in the Navy specifications.[5]

Butt-weld tubes: Butt-weld tubes are made by heating the skelp to a welding temperature and then drawing it through a bell-shaped

[3] Mark Manufacturing Co., Tariff Hearings, 1913. H. Doc. No. 1447, p. 1357.
[4] J. A. Campbell, Tariff Hearings, 1909. H. Doc. No. 1505, p. 2139.
[5] Liberty motor cylinders and other cylinders for compressed gases are made by first pressing the form of a cup from a heated circular plate which is forced through a succession of dies by a punch; subsequent reductions in thickness are made by drawing similar to steel tubes, the open end being swaged down.

which curls it up and welds the edges together without lapping. -weld tubes are not as strong as lap-weld tubes, and are not lly used for boilers, high pressures, or for service where they be much expanded by heat. They are mostly made in the l sizes up to 3 inches in diameter.

rganization.—The efficient conduct of the industry requires large ories and capital. The total amount of capital invested in the stry can not be ascertained, as nearly one-half of the product is e in rolling mills which make numerous products besides pipes tubes, and segregated data are not available.

1914 the capital invested in 36 establishments (with an output ed at $37,655,229) whose chief products were wrought and ght-welded pipe; steel-riveted pipe; lock-bar pipe and fittings; ted well casings; seamless cold-drawn steel tubes; umbrella rods; lar poles for electric railroads and for electric lighting, tele- h, and signal systems; and galvanized-iron pipe for heating and tilating, was $39,407,625.[6]

eographical distribution.—In 1914 there were 54 establishments, f which were rolling mills, engaged in the manufacture of iron steel pipes and tubes, other than cast-iron pipe, located in nsylvania, Ohio, New York, California, New Jersey, Illinois, shington, West Virginia, and Michigan.

istory of the industry.—Up to about 30 years ago hand-puddled was exclusively used and the quantity required was compara- ly small. For some years after this, with the introduction of l as the basic material for pipe, there were two classes of pipe wn to the trade, iron and steel. Now there are almost as many les as there are manufacturers, there being several varieties of on the market, and the same is true of steel pipe.

he development of the industry has been largely influenced by growth of urban population and manufacturing activity in other , great oil and natural gas wells, pipe lines, and gas and water ks systems having required large quantities of pipe. Domestic ufacturers have taken care of practically this entire market, as little of the foreign product is sold in this country; imports in were less than one-half of 1 per cent of the total available ly.

mestic production and consumption.—Statistics of the total stic production compared to the total consumption are not able. However, the excess of annual exports over imports ates that the American production is larger than the consump- In 1919, 2,572,500 gross tons were produced; the imports, than a small quantity of finished tubes, amounted to 309 gross whereas the exports, other than boiler tubes (equalling probably ifth of the total imports) amounted to 236,080 gross tons.

ports.—It is not possible to ascertain from official statistics the l of the total export movement owing to the classifications ted. The published figures include pipe fittings, and prior to boiler tubes were included in the figures for "All other engines parts of," and after 1918 the separate figures given for boiler s do not show the quantities. Prior to 1915 figures of cast-iron are included in the totals. The situation has been still further

[6] U. S. Census of Manufactures, 1914, Vol. II, p. 977, and Abstract, p. 113.

complicated by the greatly disturbed international trade cond which have prevailed since 1914.

In the calendar year 1919, the total pipes, tubes, and fittings, than cast-iron pipe, exported amounted in value to $43,146,41 this amount $35,229,750 was wrought pipe and fittings, $7,916,665 boiler tubes.

Exports are made to all parts of the world. The chief de tions in 1918 were Japan, Canada, Mexico, Cuba, France, an United Kingdom, in the order named, these six countries takin 60 per cent of the total.

FOREIGN PRODUCTION.

The United Kingdom and Germany have been the principal petitors of the United States in foreign markets. Production United Kingdom is on a much smaller scale than in the United S Thus, in 1918 the United Kingdom produced 78,267 tons of and tubes of all kinds,[1] whereas the American productio 2,583,373 tons, exclusive of cast-iron pipe, which, if included, make the total 3,203,046 tons.

About three-fourths of the English product is exported, the part going to British colonial possessions and the rest chiefly to European countries. In 1918 the exports (57,641 tons) amoun over 73 per cent of the total production. In the same ye United States exported 102,130 tons, exclusive of boiler tubes cording to official statistics of the United Kingdom, the imp 1918 amounted to 1,291 tons, of which 1,138 tons were receive the United States.

During the period immediately preceding the European (1914–1918) English exports ranged above 160,000 tons an imports in 1913 amounted to 52,816 tons, the largest part of came from Germany. Ordinarily the United Kingdom export three to four times as much as it imports.

Statistics of German production are not available, but it is that during the years immediately preceding the war Germany duction exceeded the domestic consumption. In prewar time many's exports were very much larger than the imports; further the volume of the annual export trade increased greatly, w imports decreased. Thus, in 1910 the exports were 144,295 tons and in 1913, 293,754 tons, an increase in four years of ov per cent, whereas the imports in 1910 were 10,517 gross tons 1913, 7,355 tons, or a decrease in the four-year period of 30 per Since the war, conditions in the German iron and steel industry changed materially for the worse, and the production of pipe tubes in that country at the present time (1920) is probably not cient to meet the domestic demand.

The exports were made to many countries in both the Easter Western Hemispheres, but by far the largest trade was with ne European nations; only comparatively small quantities were s countries of the Western Continent. Fully two-thirds of the fo product entering the country was imported from Sweden, and th chiefly from Great Britain, Belgium, France, and Austria-Hung

[1] Statistical Report, 1918, National Federation of Iron and Steel Manufacturers, London, Eng

IMPORTS.

Compared to production the annual imports of the United States small, importation being naturally restricted because of the differ-ce in the European threads and the standard threads employed in erica. Whereas it is possible to join American pipe of standard read to European pipe of standard thread in the small sizes, in the ge sizes a joint is impossible.

Statistics prior to 1919 showing total quantites are not available, as cial tabulations do not indicate the quantities for all of the differ-t kinds.

The value of the total importations of pipes and tubes, other than st-iron pipe, in the fiscal year 1919 ($35,926) was the smallest in y year during at least a half century. The largest annual importa-n on record ($542,051) was made in 1913, just prior to the enact-nt of the present tariff law. The imports in 1914 were also large, mounting to $433,747. The large decrease after 1914 is accounted r largely by conditions arising out of the war, chief among which re depleted stocks and increased domestic consumption in the for-gn exporting countries.

Statistics showing the sources of imports are not available.

PRICES.

Prices of wrought iron and steel pipes and tubes are based on a andard list price, known as the "Pittsburgh Card," established by anufacturers in 1913, and all quotations are given in discounts from e list. A copy of the standard list prices may be consulted by ferring to the auxiliary file of the Tariff Commission on wrought pes and tubes, No. 172A.

The "Standard list" shows standard wrought pipe, in sizes from inch to 12 inches, listed under steam, gas, and water pipe; extra rong; and hydraulic. Standard wrought casings, in sizes from 2 to 5 inches, are listed under screw and socket and inserted joint. Other nds are listed under large outside dimension pipe, from 14 to 30 ches; standard boiler tubes, both seamless and lap-welded, from to 13 inches; reamed and drifted pipe, from 2 to 6 inches, and ational redrawn pipe, from 1¼ to 2 inches. Most boiler tubes are ow made to conform to the American Society of Mechanical Engi-eers' Boiler Code.

Discounts from list price are usually quoted subject to change with-ut notice.

As computed from the published discounts, prices on ½-inch butt-eld black iron pipe on October 28, 1920,[8] ranged from $158 to $180 r gross ton, and lap-weld, $162 to $180; butt-weld black steel pipe, 02 to $110, and lap-weld, $112 to $120. Boiler tubes, 2 inches in ameter, butt-weld, $104 to $126, and charcoal, $109 to $116 per oss ton.

Prices in 1920 were very much higher than those prevailing during e period immediately preceding the war. Thus, compared with e above-mentioned prices, the prices on January 29, 1914, butt d lap-weld black iron pipe ranged from 122 to 160 per cent, and el pipe from 96 to 137 per cent higher; lap-weld boiler tubes from

[8] Discount quotations taken from the Iron Age. See page 33.

108 to 152 per cent, and charcoal from 65 to 76 per cent higher.[9] In the case of standard pipes and tubes, the larger the diameter the lower the price per ton.

Seamless tubes, on October 28, 1920, were quoted at $327 a ton for standard commercial and $207 a ton for cold-drawn or hot-rolled. Seamless tubes were not quoted in trade papers prior to the war (1914–1918).

Prices on foreign-made pipe are not at hand.

TARIFF HISTORY.

The act of 1894 provided an ad valorem duty of 25 per cent. The rate was changed in the act of 1897 to a specific rate of 2 cents per pound on lap-welded, butt-welded, seamed, or jointed iron or steel boiler tubes, pipes, flues, or stays, not thinner than No. 16 wire gauge, and to 35 per cent ad valorem on all other iron or steel tubes, finished, not specially provided for.

Divisions were made in the act of 1909 as to various kinds and sizes and specific rates were provided ranging from 1 to 2 cents per pound; and all other, finished, not specially provided for, were given a rate of 30 per cent ad valorem. Following these reductions increases in annual imports occurred.

The act of 1913 provides a single rate of 20 per cent ad valorem on all the different kinds and sizes. This was a further reduction and increases in imports occurred in most of the different kinds almost immediately after the act became operative.

COMPETITIVE CONDITIONS.

International trade in iron and steel pipe is restricted largely by the difference between American and European standard threads, which practically prohibits interchange in the use of the products. This difference has been an important factor in curtailing the sale of both the European product in the United States and the American product in foreign countries where the European standards are in common use.

Leading American manufacturers are somewhat less affected by this condition than their European competitors because of their large manufacturing capacity, large output, and greater equipment for making pipe with special threads.

Another factor in the situation is the higher cost of manufacturing pipe with the kind of thread generally used in England (Whitworth shape) over the cost of the thread generally used in the United States (Briggs's Standard). The Whitworth shape, having the tops and bottoms of the threads rounded, is more difficult to make than the Briggs's Standard, which is V shaped.

The establishment of an international thread which will be standard throughout the world is being seriously considered by the trade.

In Great Britain it is stated,[10] the trade has suffered from prohibitive tariffs abroad, competition from bounty-fed tubes, and from high railway and shipping rates, which are said to be excessive as

[9] Discount quotations taken from the Iron Age. See page 33.

[10] British Report of the Departmental Committee Appointed by the Board of Trade to Consider the Position of the Iron and Steel Trades after the War. 1918.

npared with Germany and America. Prior to the war (1914–1918) ociated makers imported 20 per cent of the iron and steel and 40 cent of the spelter used in the manufacture of standard tubes, ereas practically all the makers of seamless tubes without rolling ls depended upon imported billets or rolled tubes, a large part of ich was received from Sweden. The English industry in lap-weld n and steel tubes for locomotives was fast dying out, prior to the r, because of the free entry of low-priced German tubes. All steel es for naval boilers and steam pipes for use of the Admiralty are uired by the British Government to be made of British steel.

The American industry from the beginning has had the protection a higher duty than its principal foreign competitors, Germany and eat Britain. In Great Britain imports have been admitted free of ty, and in Germany the rate is only about $7 a ton, whereas in the ited States the duty has never been less than one-fifth of the value the imported product.

The position of America in international trade is fittingly set forth the following excerpts from the Ironmonger (London) of September , 1920:

The real reason of America's ability to undersell the British steel makers at the sent time, of which the significance is not appreciated in this country as it should , is that the cost of production of coal and iron in Great Britain has gone up above American level. Wages have always been higher in the United States than in s country, and the resulting high costs of manufactured goods checked the expan- n of the American export trade in such articles. But the heavy advance in wages Great Britain within the last five or six years, which has now brought them close the American level, is giving the American steel makers an equal or even a better portunity of doing business in overseas markets, and that condition constitutes a ious menace to one of our most important industries. The consequences must in- itably be the loss of our export trade unless the costs of production at home can be t down without lowering wages, and that seems to be out of the question.

The last decade has witnessed a marked advance in the installation in this country labor and time saving mechanical processes in the manufacture of iron and steel d in raising coal, but the possibilities in this direction have by no means been hausted. Americans who have lately had opportunities of comparing the practices both countries unanimously declare that Great Britain still lags a long way behind United States in the adoption of such devices, and express their surprise at the ny laborious operations still habitually carried on here by hand that in America done more quickly and more cheaply by automatic machinery. The time has come when America stands to benefit by its long experience of scarce and dear r, which stimulated the introduction of mechanical devices. British industry needs to learn the same lesson. Sir Robert Hadfield asserts that the past cheap- s of coal has given British manufacturers the habit of wasting it, and to some ent they may have contracted a similar habit with respect to manual labor.

early all the great American manufacturing concerns have large and well equipped es in the Orient, according to Mr. William Pigott, president of the Pacific Car & ndry Co., and vice president of the Pacific Coast Steel Co., who recently visited na and Japan in order to study the conditions of the steel trade in those countries. further stated:

Contrary to the general impression that Americans and the American Government neglecting foreign fields, the Department of Commerce is supplying every assist- e to American business men and manufacturers who seek to establish themselves foreign trade. In addition, American manufacturers, bankers, transportation erests, and shipping companies are canvassing the field thoroughly and laying foundation for a stable, permanent business."

Although the average pay of the laborer in the Chinese iron mines and steel plants 0.25 per day of 10 or 12 hours and the American laborer is paid $4.50 per day of ours, steel is made in the United States $20 per ton cheaper than in China and an. Mr. Pigott does not believe that either China or Japan will ever become e competitors with America in Europe in the steel business.

Germany has been practically eliminated, at least for some time t come, as an important competitor by the outcome of the war.

In former years Swedish iron was largely used by American manu facturers in making wrought-iron tubes, but this practice has gradual grown less until at the present time, although admitted free of duty very little of the imported material is employed, it having bee replaced by domestic wrought iron, mild steel, or a special variety o skelp iron made from steel scrap in a charcoal sinking fire.

Pipes and tubes: Wrought welded—Production in United States.

[From Federal Census.]

State.	1910		1914	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
Ohio	566,975	$36,971,581	523,926	$24,361,10
Pennsylvania	654,042	36,929,123	571,456	29,441,2
All other	93,754	4,570,867	35,270	1,639,2
Total	1,314,771	68,471,573	1,130,652	55,461,6

Pipes and tubes: Seamless, hot finished or cold drawn—Production in United States.

[From Federal Census.]

State.	1910		1914	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
Michigan	(1)	(1)	(1)	(1)
Pennsylvania	(1)	(1)	(1)	(1)
Total	54,273	$5,650,739	64,765	$5,821,4

[1] Included in total, but amount not shown in order to avoid disclosing individual operations.

Pipes and tubes: All other, clinched, riveted, etc.—Production in United States.

[From Federal Census.]

State.	1910		1914	
	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*	
Ohio	(1)	(1)	(1)	(1)
Pennsylvania	(1)	(1)	(1)	(1)
All other				
Total	17,561	$986,699	17,345	$834,3

[1] Included in total, but amount not shown in order to avoid disclosing individual operations.

Wrought-iron and steel pipes and tubes (includes seamless tubes)—Production in United States.

[From Annual Statistical Report of the American Iron and Steel Institute.]

	Gross tons.		Gross tons.
1913	2,451,099	1917	2,711,6
1914	1,828,200	1918	2,595,3
1915	2,050,342	1919	2,372,9
1916	2,841,541		

Wrought pipe and boiler tubes—Production in United States.

[From Annual Statistical Report of the American Iron and Steel Institute.]

Year.	Black, standard.	Galvanized.	Oil-country goods.	O. D. and miscellaneous.	Boiler tubes.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
1913	830,472	266,940	841,089	179,211	127,820	2,245,532
1914	664,507	265,029	619,291	111,385	77,492	1,737,704
1915	823,767	280,944	602,920	115,113	96,930	1,919,674
1916	1,132,643	291,013	940,491	138,763	148,148	2,651,058
1917	1,059,747	275,305	887,903	115,690	148,332	2,486,977
1918	1,015,785	264,682	794,769	91,157	124,086	2,290,479
1919	827,082	268,156	1,068,914	120,670	90,109	2,374,931

Seamless steel tubes—Production in United States.

[From Annual Statistical Report of the American Iron and Steel Institute.]

Year.	Hot-finished.	Cold-drawn.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*
1913	42,740	65,827	108,567
1914	36,939	53,656	90,595
1915	63,488	76,180	139,668
1916	61,235	129,238	190,473
1917	87,615	139,060	226,675
1918	142,308	150,586	292,894
1919	75,864	121,505	197,369

Wrought pipe and boiler tubes, showing iron and steel separately—Production in United States.

[From Annual Statistical Report of the American Iron and Steel Institute.]

Kinds of pipe.	1917			1918		
	Iron.	Steel.	Total.	Iron.	Steel.	Total.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*	*Gross tons.*
Black, standard	90,119	969,628	1,059,747	74,871	940,914	1,015,785
Galvanized	25,949	249,356	275,305	20,209	244,473	264,682
Oil-country goods	102,337	785,566	887,903	67,136	727,633	794,769
O. D. and miscellaneous	90	115,600	115,690	.....	91,157	91,157
Boiler tubes	55,395	92,937	148,332	40,742	83,344	124,086
Total	273,890	2,213,087	2,486,977	202,958	2,087,521	2,290,479

Total wrought pipes and tubes of iron and steel [1]*—Imports for consumption—Revenue.*

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	.....	[2]	$117,844	$43,194	.....	.....
1908	.....	[2]	98,565	36,273	.....	.....
1909	.....	[2]	122,091	43,256	.....	.....
1910	.....	[2]	164,686	51,306	.....	.....
1911	.....	[2]	166,458	50,625	.....	.....
1912	.....	[2]	161,240	48,041	.....	.....
1913	.....	[2]	542,051	164,189	.....	.....
1914	.....	[2]	433,747	102,082	.....	.....
1915	.....	[2]	147,086	28,207	.....	.....
1916	.....	[2]	42,387	7,257	.....	.....
1917	.....	[2]	82,944	15,876	.....	.....
1918	.....	[2]	154,525	29,327	.....	.....
1919	.....	691,047	35,926	7,185	.....	.....
1920 [3]	.....	690,714	62,639	12,527	.....	.....

[1] Includes furnaces and cylindrical tubes. [2] Figures not available. [3] Calendar year.

Furnaces, welded, cylindrical, and tubes or flues made from plate metal, and corrugated, ribbed, or otherwise reinforced against collapsing pressure—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	2½ cents per pound.	71,722	$4,274	$1,793	$0.06	41.95
1908	....do	19,866	903	496	.046	55.00
1909	....do	20	5		.250	
1910	2 cents per pound.	307,186	13,658	6,143	.044	44.98
1911	....do	350,490	15,336	7,009	.044	45.71
1912	....do	130,970	5,450	2,619	.042	48.06
1913	....do	232,329	10,354	4,646	.045	44.87
1914 [1]	....do	5,465	233	109	.043	46.78
	20 per cent	170,388	6,142	1,228	.036	20.00
	Duty remitted, Sec. IV, J5.	71,667	12,111		.169	
1915	20 per cent	48,731	1,497	299	.031	20.00
	Duty remitted	98,059	6,047		.061	
1916	20 per cent	800	62	12	.078	20.00
	Duty remitted	82,164	6,100		.074	
1917	20 per cent	55,462	5,570	1,114	.100	20.00
	Duty remitted	35,600	3,564		.100	
1918	20 per cent	70	7	1	.100	20.00
	Duty remitted	71,372	7,888		.110	
1919	20p er cent	143,502	18,897	3,779	.132	20.00
1920 [2]	....do	59,580	8,777	1,755	.147	20.00

[1] July 1 to Oct. 3, 1913, under act of 1909. [2] Calendar year.

Tubes, pipes, flues, or stays, lap-welded, butt-welded, seamed, or jointed, not thinner than No. 16 wire gauge, not less than ¼ inch in diameter (except made of charcoal iron)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1907	2 cents per pound.	952,989	$49,740	$19,059.78	$0.052	38.32
1908	....do	685,601	34,619	13,712.02	.052	39.61
1909	....do	158,128	7,534	3,162.56	.048	41.97
1910 [1]	1 cent per pound.	94,031	5,992	940.31	.059	15.69
1911	....do	319,639	16,112	3,196.39	.050	19.84
1912	....do	81,804	3,535	818.04	.043	23.14
1913	....do	4,467,433	146,357	44,674.33	.033	30.53
1914 [2]	....do	2,721,551	92,558	27,215.51	.034	29.40

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Tubes, pipes, flues, or stays, lap-welded, butt-welded, seamed or jointed, not thinner than No. 16 wire gauge, less than ¼ inch in diameter—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
1910 [1]	2 cents per pound.	1,680	$112	$33.60	$0.067	30.00
1911	....do	3,491	240	69.82	.069	29.08
1912	....do	5,808	193	116.17	.033	60.17

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.

pipes, flues, or stays, lap-welded, butt-welded, seamed or jointed, not thinner than 16 wire gauge, less than ⅜ inch and not less than ¼ inch in diameter, and not less ⅜ inch in diameter made of charcoal iron—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	1½ cents per pound.	3,600	$139	$54.00	$0.044	33.96
.....	.....do.....	3,064	424	45.96	.138	10.84
.....	.....do.....	264	11	3.96	0.42	36.00
.....	.....do.....	9,497	443	142.46	.047	32.16

, 1909, to June 30, 1910, under act of 1909.

pipes, flues, or stays, lap-welded, butt-welded, seamed or jointed—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	20 per cent.....	64,509	$4,295	$859.00	$0.067	20.00
.....	.....do.....	102,568	6,971	1,394.20	.068	20.00
.....	.....do.....	1,082,085	16,493	3,298.60	.015	20.00
.....	.....do.....	1,090,836	26,975	5,395.00	.025	20.00
.....	.....do.....	1,633,967	76,647	15,329.40	.047	20.00
.....	.....do.....	524,869	15,238	3,047.60	.029	20.00
.....	.....do.....	527,122	39,886	7,977.20	.076	20.00

, 1913, to June 30, 1914, under act of 1913. [3] Calendar year.

Tubes, finished, n. s. p. f.—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	35 per cent.....	.....	$63,830	$22,340.50	.....	35.00
.....	.....do.....	.....	63,043	22,065.14	.....	35.00
.....	.....do.....	.....	114,552	40,093.24	.....	35.00
.....	.....do.....	.....	11,727	4,104.45	.....	35.00
.....	30 per cent.....	.....	133,438	40,031.40	.....	30.00
.....	.....do.....	.....	134,346	40,303.80	.....	30.00
.....	.....do.....	.....	148,280	44,484.15	.....	30.00
	Duty remitted, sec. 19.	.....	3,771	.....	.....	.....
.....	30 per cent.....	.....	382,422	114,726.60	.....	30.00
	Duty remitted, Panama act.	.....	2,475	.....	.....	.....
.....	30 per cent.....	.....	113,417	34,025.10	.....	30.00
.....	20 per cent.....	.....	193,226	38,645.20	.....	20.00
	Free, Sec. IV, 15...	.....	11,765	.....	.....	.....
.....	20 per cent.....	.....	132,571	26,514.20	.....	20.00
.....	.....do.....	.....	19,732	3,946.40	.....	20.00
.....	.....do.....	.....	46,835	9,367.00	.....	20.00
.....	.....do.....	.....	69,983	13,996.60	.....	20.00
.....	.....do.....	22,676	1,791	358.20	$0.079	20.00
.....	.....do.....	104,012	13,976	2,795.20	.134	20.00

1 to Aug. 5, 1909, under act of 1897.
6, 1909, to June 30, 1910, under act of 1909.
1 to Oct. 3, 1913, under act of 1909.
[4] Oct. 4, 1913, to June 30, 1914, under act of 1913
[5] For construction and equipment of vessels.
[6] Calendar year.

Total wrought pipes and fittings, including boiler tubes—Domestic exports.

Exported to—	Fiscal year 1918.	Exported to—	Fiscal
Denmark	$18,702	Peru	
France	1,599,643	China	
Italy	394,395	British East Indies	
Norway	188,527	Dutch East Indies	
United Kingdom	1,053,288	Japan	
Canada	3,074,010	Persia	
Mexico	2,747,344	Australia	
Cuba	1,675,545	Egypt	
Argentina	592,359	All other	
Brazil	569,980		
Chile	865,387	Total	

Pipes and fittings, wrought [1]—Domestic exports.

Exported to—	Fiscal year.			
	1915		1916	
	Pounds.		*Pounds.*	
Denmark	1,487,696	$30,595	4,799,901	
France	799,186	16,789	7,525,807	
Italy	4,277,582	107,992	6,854,630	
Norway	5,650,137	119,352	2,251,364	
United Kingdom	42,900,079	964,331	53,607,719	1,
Canada	29,960,146	862,476	22,443,832	
Mexico	16,109,536	464,173	14,993,898	
Cuba	16,998,998	461,826	23,736,894	
Argentina	4,857,851	129,873	14,978,181	
Brazil	6,466,754	187,990	4,461,312	
Chile	1,434,736	42,170	2,526,168	
Peru	6,094,631	191,071	4,537,165	
China	1,761,301	47,914	3,479,568	
British East Indies	13,737,225	323,101	8,270,578	
Dutch East Indies	5,458,280	135,066	10,432,117	
Japan	19,411,147	500,053	18,572,835	
Persia	24,755,902	504,305	1,818	
Australia	18,288,507	470,600	16,773,330	
Egypt	26,816	745	16,303,184	
All other	43,160,460	1,232,097	44,855,657	1,
Total	263,636,970	6,792,519	281,405,955	8,

Exported to—	Fiscal year.			
	1917		1918 [2]	
	Pounds.		*Pounds.*	
Denmark	13,581,976	$432,063	543,622	
France	13,383,416	718,461	4,111,391	
Italy	7,779,569	451,910	3,312,233	
Norway	9,000,901	411,063	3,608,216	
United Kingdom	33,243,745	1,337,328	15,378,767	
Canada	35,909,003	1,735,203	24,341,603	1,
Mexico	25,530,974	1,082,735	32,337,711	2,
Cuba	33,202,539	1,422,788	16,241,194	1,
Argentina	8,313,947	378,075	6,195,101	
Brazil	7,632,196	380,774	6,374,234	
Chile	7,511,269	348,748	11,433,446	
Peru	10,521,276	378,855	1,087,852	
China	2,887,009	164,032	4,372,669	
British East Indies	28,134,604	1,088,123	9,548,077	
Dutch East Indies	24,429,038	845,933	7,459,225	
Japan	31,292,260	1,431,585	46,921,198	3,
Persia	10,293,137	363,914	660,880	
Australia	6,636,179	295,836	4,483,677	
Egypt	24,068,376	953,718	6,128,136	
All other	45,010,043	2,075,689	24,232,945	1,
Total	378,361,457	16,296,833	228,772,177	16,

[1] Include l "cast-iron pipe and l fittings" prior to 1915. Figures do not include boiler tubes.
[2] Does not include boiler tubes.

Pipes and fittings, wrought—Domestic exports—Continued.

Exported to—	Calendar year.			
	1918		1919	
	Pounds.		*Pounds.*	
	875,800	$37,852	9,992,204	$479,103
	3,049,099	334,541	10,313,746	823,078
	286,633	21,719	1,791,179	144,109
	2,081,756	103,929	10,035,580	613,346
dom	7,945,710	557,387	20,133,422	1,276,255
	19,136,756	1,300,150	13,418,933	1,064,280
	26,369,448	1,845,878	107,027,095	6,121,675
	14,790,213	1,105,900	23,531,185	1,593,769
	6,649,511	509,595	16,156,368	1,261,218
	4,936,436	380,180	15,849,206	1,210,312
	11,688,973	977,612	8,228,193	692,303
	1,386,704	102,850	14,700,742	1,026,209
	4,652,057	379,103	7,712,126	666,129
Indies	9,307,988	694,010	63,776,027	4,374,847
Indies	9,298,182	605,322	43,008,963	2,796,163
	47,173,025	3,430,366	57,926,988	3,877,656
			8,025,920	451,368
	7,495,957	545,577	11,962,853	875,830
	270,120	20,567	793,487	62,024
	24,165,693	2,041,419	84,435,290	5,820,076
	201,560,061	14,993,957	528,819,507	35,229,750

Boiler tubes [1]*—Domestic exports.*

Exported to—	Fiscal year 1918.	Exported to—	Fiscal year 1918.
	$1,337,369	Peru	$31,375
	193,752	China	48,184
	2,600	British East Indies	98,379
dom	90,111	Dutch East Indies	40,994
	1,588,645	Japan	892,815
	354,866	Australia	31,567
	541,813	All other	890,071
	87,883		
	101,601	Total	6,411,439
	79,414		

ted to—	Calendar year—		Exported to—	Calendar year—	
	1918	1919		1918	1919
	$1,734,255	$1,326,615	Peru	$23,688	$61,769
	118,172	453,589	China	80,847	202,397
	20,469	71,344	British East Indies	58,107	61,724
dom	39,879	20,502	Dutch East Indies	14,566	223,898
	1,960,934	1,287,368	Japan	386,411	1,399,211
	455,339	321,600	Australia	21,767	49,758
	322,665	345,099	All other	871,314	1,625,625
	42,591	173,918			
	134,437	197,680	Total	6,405,728	7,916,665
	120,287	124,568			

n "All other engines, and parts of" prior to 1918.

Wrought iron and steel pipe—Prices per gross ton in carload lots at Pittsburgh.

[Computed from discount quotations in Iron Age.]

Kinds or grades.	Size.	Butt-welded.		Lap-welded.	
		Jan. 29, 1914.	Oct. 28, 1920.	Jan. 29, 1914.	Oct. 28, 1920.
Iron:					
Black	½-inch	$69	$158–$180	$73	$163–$
Galvanized	do	99	198– 221	95	194–
Steel:					
Black	do	52	102– 110	52	113–
Galvanized	do	75	134– 142	71	149–

Boiler tubes and seamless tubes—Prices per gross ton in carload lots at Pittsburgh.

[Computed from discount quotations in Iron Age.]

Kinds or grades.	Size.	Jan. 29, 1914.	Oct. 28, 1920.
Lap-welded	2-inch	$50	$104–$
Charcoal-iron	do	66	199–
Seamless tubes:			
Standard and common	1-inch		
Cold-drawn or hot-rolled	1¼-inch		

Court and Treasury Decisions.

Seamless tubes of chromium steel designed to be used not as tubes but as materials for the manufacture of other articles, such as ball races for ball bearings, are within the provision in paragraph 127 of the act of 1913 for "all other iron or steel tubes, finished, not specially provided for," and not dutiable under the provision in paragraph 110 for "all steels, by whatever process made, containing alloys, such as * * * chromium." Whether or not an article is a tube depends upon its form and not upon use or method of manufacture. (Ball *v.* United States, 8 Ct. Cust. Appls., 143, of 1917.)

The word "pipe" generally implies an article tubular in form and rigid, while "tubing" implies a flexible article. The provision for flexible metal tubing or hose is more specific than that for copper pipes. (Hensel *v.* United States, 2 Ct. Cust. Appls., 221, of 1911.)

Unused butt-welded iron and steel pipe, which comes from the mill defective for high-pressure purposes, cut into lengths and used as guard rails, fence posts, rollers, building columns or supports, fences, flag poles, etc., is dutiable as butt-welded iron or steel pipe under paragraph 127; but, if fit only for remanufacture, is free of duty as scrap steel under paragraph 518. (Abstract 39168 of 1915; Abstract 39572 of 1916.)

"All other iron or steel tubes," whether finished or unfinished, pay 20 per cent, but under different paragraphs—the finished are under paragraph 127 and the unfinished are under paragraph 167.

Tubes, pipes, flues, or stays, n. s. p. f.—Rates of duty.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
....	169	Boiler tubes, or flues, or stays, of wrought iron or steel.....	3 cents per pound.
....	157	Boiler or other tubes, pipes, flues, or stays of wrought iron or steel.	2½ cents per pound.
....	130	.....do.....	25 per cent ad valorem
....	152	Lap-welded, butt-welded, seamed, or jointed iron or steel boiler tubes, pipes, flues, or stays, not thinner than No. 16 wire gauge.	2 cents per pound.
		* * * all other iron or steel tubes, finished, not specially provided for in this act.	35 per cent ad valorem.
....	151	Lap-welded, butt-welded, seamed, or joined iron or steel tubes, pipes, flues, or stays, not thinner than No. 16 wire gauge:	
		If less than three-eighths of an inch in diameter.....	1 cent per pound.
		If less than three-eighths of an inch and not less than one-fourth of an inch in diameter.	1½ cents per pound.
		If less than one-fourth of an inch in diameter.....	2 cents per pound.
		Provided, That no tubes, pipes, flues, or stays, made of charcoal iron shall pay a less rate of duty than.	1½ cents per pound.
		Welded cylindrical furnaces, tubes, or flues, made from plate metal, and corrugated, ribbed, or otherwise reinforced against collapsing pressure.	2 cents per pound.
		All other iron or steel tubes, finished, not specially provided for in this section.	30 per cent ad valorem.
....	127	Lap-welded, butt-welded, seamed, or jointed iron or steel tubes, pipes, flues, or stays; * * * tubes or flues made from plate metal, and corrugated, ribbed, or otherwise reinforced against collapsing pressure, and all other iron or steel tubes, finished, not specially provided for in this section.	20 per cent ad valorem.

MISCELLANEOUS.

mmary of wrought, welded, and seamless iron and steel tubes not made in rolling mills, 1914.

[From report of the U. S. Bureau of the Census, 1914.]

ablishments	36
sons engaged in the industry	9,690
Proprietors	10
Salaried officers, superintendents, and managers	224
Clerks	611
Wage earners (average)	8,845
ital	$39,407,625
aries and wages	6,995,285
Officials	750,286
Clerks, etc	494,639
Wage earners	5,750,360
nt of factory	12,571
es, including internal revenue and corporation income	136,377
erials	25,311,323
and rent of power	984,465
ue of products	37,655,229
ue added by manufacture	11,359,441
nary horsepower	17,542
Steam engines	14,490
Internal combustion engines	65
Electric:	
Rented	2,987
Generated in establishment	22,677

DIGEST OF TARIFF HEARINGS.

Hearings in 1913 before the Committee on Ways and Means are orded in House Document No. 1447, Sixty-second Congress, third sion, as follows: Wrought steel tubes, page 1354; boiler tubes, ges 1352–1358; charcoal-iron tubes, page 1358.

n the brief of Worth Bros. Co., Coatsville, Pa., interested in steel tes, charcoal-iron boiler tubes, and pig iron, a protest is made inst any radical tariff changes, and opposition is expressed against valorem duties. Located in the East, they are already handi-

capped by freight charges on ores and fuel greatly in excess of weste competitors, and that a preferential duty on products made of ch coal iron is necessary to protect a struggling industry, where quant clashes with quality. Scrap iron should be entered either free or a low rate of duty; ferromanganese should have a fixed instead of ad valorem rate of duty, and fluorspar and Swedish iron should free of duty.

Daniel J. Driscoll, representing the Pittsburgh Steel Products C the Pittsburgh Seamless Tube Co., the Ohio Seamless Tube Co., Globe Seamless Tube Co., the Detroit Seamless Tube Co., and Delaware Seamless Tube Co., pleads for protection that will ena the manufacturers of seamless tubing to continue the manufact at a fair and just profit. The manufacture of seamless tubing is comparatively new industry, the product of which must eventua supersede lap-weld tubing for all high pressure work, and shou pay a duty of 30 or 35 per cent ad valorem, and, also have a separa classification in the tariff.

A brief of the Mark Manufacturing Co., manufacturers of wrou steel pipe and boiler tubes, Zanesville, Ohio, and Evansville, I describes the process of manufacture, and states that the numero operations, the handling and preparation of pipe for the mark labor and other items contingent to its manufacture are such th the value of the finished pipe is equal to about double the value of t plates, and on account of the large amount of manufacturing lab necessary they should not be classified with the heavier steel produc where material comprises nearly the entire cost. Foreign manuf turers have erected modern plants for the production of pipe. T number of foreign mills that have been equipped throughout in t last few years with American machinery are: Germany, 8; Scotla 2; Austria, 1; Russia, 1; and Italy, 1; besides other mill owners ha purchased parts of American machinery for the improvement their plants. It is estimated that 85 or 90 per cent of the to domestic pipe is manufactured in the Pittsburgh district, and frei rates from that district to various domestic seaports are quot A disadvantage is claimed, in competing with the imported produ of at least $8 a ton in the rate of freight to the Pacific coast a southwestern points. Further reduction of the import duty objected to.

BOILERS AND TANKS OF IRON AND STEEL.

SUMMARY.

Although the manufacture of boilers and tanks of iron and steel carried on in both large and small establishments in various parts the United States, the largest part of the total domestic output nes from large factories located mostly in the States of Pennvania and Ohio. The quantity and value of the total domestic oduction are not known. However, the comparatively small ounts annually imported, and the further fact that exports are de from the United States to many foreign countries, indicates t the domestic production is fully equal to or in excess of the al domestic consumption.

Official American statistics do not disclose the sources of imports boilers and tanks. Official statistics of Great Britain and Gerny, however, show that exports are made from those countries to United States. England and Germany are probably the principal rces of American imports, but these countries are greatly handiped on account of the bulky nature of the articles, and severe ign competition is not likely, as it is practically impossible for an rseas country to compete successfully in these very bulky articles h American manufacturers in the American market, because of high ocean freight.

Tanks or vessels, of iron and steel—Summary table.

Fiscal year.	Value, imports for consumption.	Amount of duty.	Equivalent ad valorem rate.
			Per cent.
.....	$462,075	$138,374.70	29.95
.....	428,440	127,630.32	29.79
.....	499,413	149,017.68	29.84
.....	468,916	103,681.18	22.11
.....	236,911	44,980.92	19.82
.....	242,773	48,527.20	19.99
.....	234,217	46,792.20	19.98
.....	153,716	30,674.56	19.96
.....	151,651	30,329.76	20.00
.....	535,156	107,031.20	20.00

Calendar year.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

27. * * * cylindrical or tubular tanks or vessels, for holding , liquids, or other material, whether full or empty; * * * per cent ad valorem.

DESCRIPTION.

n the above-mentioned paragraph are included seamless iron and l tanks for use as containers of ammonia, acetylene gas, air, bonic acid, hydrogen and oxygen, and other substances; and ks for pneumatic pressure and for the storage of water, oil, oline, and other materials. Boilers for the generation of steam power may also be included in the above paragraph when of ndrical shape, although as these almost invariably are provided

with tubes the phrasing is not definite even in the case of ordinary fire-tube boilers which consist of a cylindrical shell fitted with heads on both ends through which pass the tubes. Water-tube boilers of various kinds are manifestly not provided for.

Various small rectangular or cylindrical tanks and vessels are made for various purposes, as for example, for use in plumbing. When made of light sheet, these articles are generally soldered, crimped or riveted, and are generally made by local tinsmiths. As such tanks are of no significance in international trade they will not be discussed in this survey.

Substitutes and competing articles are: Wooden tanks, copper tanks, and iron and steel tanks shaped other than cylindrical. Boilers, for the generation of steam power, are replaced to a considerable extent in some industries by the use of electric motors and internal combustion engines.

DOMESTIC PRODUCTION.

Seamless tanks or vessels are made by establishments manufacturing seamless pipes and tubes from plate metal, whereas the bulk of the riveted boiler and tank output is produced in boiler works and establishments doing heavy steel plate work.

Statistics of the total annual production are not available.

Raw material.—In the manufacture of seamless tanks, plate steel is employed which varies in thickness from $\frac{3}{8}$ inch to 4 inches. For steel pressure and storage tanks the material is commonly soft, open-hearth steel sheet from $\frac{3}{16}$ inch to $\frac{3}{4}$ inch in thinkness. Boiler plate is a high quality of wrought iron or steel, and is more costly than ordinary plate steel. These materials are secured in abundant quantities from American rolling mills; if imported the duty under the present law is 8 per cent ad valorem on plain sheets and plates and 15 per cent if the material is galvanized.

Equipment.—A modern establishment for the manufacture of seamless cylinders and tanks is equipped with shears, punches, hydraulic presses, dies, and heating and annealing furnaces, and for the manufacture of riveted tanks, boilers, etc., shears, punches, drills, rolls, riveting machines, and traveling cranes. The equipment used is almost exclusively of American manufacture.

Methods of manufacture.—Seamless cylinders and tanks are almost always made by the plate-cupping process. By this process steel plate is cut into squares according to the size of the tube to be made. After heating, round disks are punched from the squares and pressed through a succession of dies until a tubelike form is obtained, after which the article is drawn down on a horizontal draw bench to the desired size by passing it through a number of dies, each of which is smaller in size than the die immediately preceding it. The article, now of cup shape, is placed over a punch on the end of a hydraulic plunger and forced through a series of dies, each successively smaller, which operation elongates the cup into the final size. For making the tube into a cylinder or closed tank, the open end is forced shut by a spinning process which welds the edges together. Repeated heatings and annealings are necessary throughout the process.

High-pressure tanks, of 5 and 10 gallon capacity, for use in oil-burning systems, and gasoline lighting plants, are made of galvanized sheet steel of 18, 20, and 22 gauge, according to the part and diameter of the tank. The ends and bottoms of the tanks are stamped from

flat sheet in presses. The sides are cut to length and width and whole tank assembled by riveting and soldering.

In the manufacture of cylindrical or tubular plate-metal tanks the el plate is first "laid out" to correspond with the drawing. It is n cut to required sizes and the parts punched or drilled to corre- ond to the drawing, bevel sheared or planed on such edges as require king, rolled in a set of bending rolls, bolted together to hold them position while being riveted or welded, as may be required.

After being riveted or welded the edges of the plates at all seams calked and the tank is tested by hydrostatic pressure. Any ky rivets are then calked or replaced by new rivets. The testing d adjusting process is repeatedly continued until the tank is tight.

Cast-iron circular tanks are made from flanged plates cast to the uired shapes and dimensions. Holes are drilled through the ges for the insertion of bolts and the parts securely fastened ether with bolts.

Organization.—Large factories and much capital are required to ain the highest degree of efficiency, though the business can be ducted efficiently in small factories. American manufacture is ducted in both large and small factories, and although there are ny more small establishments than there are large ones, the bulk he total domestic output comes from large establishments.

Geographical distribution.—The establishments are located mostly ections of the country where rolling mills are found, obviously for convenience in obtaining raw materials and the economy of a rt haul for very heavy material. The largest producing centers located in the States of Pennsylvania and Ohio.

History of the industry.—The growth of the domestic industry has n influenced largely by the development of manufacture in other s, among which may be mentioned oil refineries, chemical works, ber factories, paper mills, powder works, gas works, locomotive ks, machine shops, garbage and rendering plants, creosoting nts, sugar mills and refineries, and industries requiring high- ssure tanks. The industry from the beginning has been favored h a protective tariff which has never amounted to less than 20 per t ad valorem, and foreign importation being comparatively light erican manufacturers have held the domestic market almost entire- o themselves, besides manufacturing to some extent for export.

Domestic production and consumption.—The amount and value of domestic production or of consumption is not known. It is, how- r, known that the domestic output is fully equal to the amount sumed.

Domestic exports.—Exports are made to all parts of the world, but tistics of total amounts and values are not available.

FOREIGN PRODUCTION.

As competitors in the markets of the United States, foreign nations ve been of minor importance. Great Britain and Germany are the ncipal countries exporting to this country, the quantities being nparatively small.

IMPORTS.

In the fiscal year 1919 the total imports of tanks or vessels for ding gas, liquid, or other material, whether full or empty, amounted $151,651. This was the smallest importation since 1911, the first

year that import statistics were compiled by the Government. The largest annual importation during the period occurred in 1913, when they were valued at $499,413. Official American statistical data do not reveal the sources of imports. Statistics of the German Government show that in 1913 (the latest published data) 240 gross tons of cask buoys for anchors, and reservoirs for gas, water, and other purposes were exported to the United States.

Separate statistics of imports of boilers are not compiled by the United States Government, but are included with other manufacturers of iron and steel not specially provided for. Figures taken from official English and German publications show that in 1913 England exported 114 tons, and in 1918, 576 tons, of boilers to this country, whereas the exports of Germany to this country in 1913 amounted to 300 tons.

PRICES.

Prices vary in accordance with kind, size, material used, specifications, and fluctuations in the raw-material market; therefore quotations are generally made upon request.

TARIFF HISTORY.

Cylindrical or tubular tanks or vessels received separate mention in the tariff law for the first time in the act of 1909, which fixed the rate of duty at 30 per cent ad valorem. Prior to the act of 1909 these articles were admitted under the paragraph for articles or wares wholly or partly manufactured of iron or steel not specially provided for, at 45 per cent ad valorem. The act of 1913 reduced the rate to 20 per cent ad valorem.

Boilers are not specifically mentioned in any of the tariff acts; being admitted under the paragraph for articles and wares wholly or partly manufactured of iron or steel not specially provided for, at ad valorem rates varying from 45 to 20 per cent.

A reduction of 20 per cent in the duty is made to Cuba under a reciprocity treaty of the United States with that country.

COMPETITIVE CONDITIONS.

Very little competition in boilers and tanks from foreign sources obtains in this country. The high cost of transporting bulky articles by ocean steamship makes it practically impossible for foreign manufacturers of boilers and tanks to compete in the American market. American boiler and tank works are widely distributed, and usually railroad freights from the nearest factory to the point of consumption (even on the Pacific coast) will be materially lower than the cost of transport from abroad. The industry in the United States is conducted along modern lines, and is amply equipped to meet any demands that may be made upon it; raw materials (plates, sheets, rivets, etc.) of domestic origin are plentiful and usually may be obtained at no great distance from the manufacturer. Furthermore, foreign competitors are subject to an import duty on their products sold in the United States of 20 per cent ad valorem.[1]

[1] It has been recently reported that large numbers of tanks used during the war for holding poison gas and for oxyacetylene cutting and welding outfits are likely to be offered on the American market. The matter has not yet been investigated, but further data may be expected prior to February, 1921.

TARIFF CONSIDERATIONS.

agraph 127 classifies iron or steel tanks and vessels according pe, specifying only cylindrical or tubular kinds, whereas rec- ar and other shapes, not being specifically mentioned in the act, come under the paragraph (167) for articles and wares or partly manufactured of iron or steel not specifically pro- for.

ether the article is cylindrical, tubular, or rectangular is appar- of little tariff importance. Of greater tariff significance is the f material from which the article is made. Thus, tanks are from common or black iron or steel sheets and plates, and iron l sheets and plates galvanized or coated with zinc, spelter, or metals. These two classes of materials are specifically men- in separate paragraphs of the act of 1913, and are dutiable and 15 per cent ad valorem, respectively.

d steel tanks or vessels, cylindrical or tubular, for holding gas, liquids, or other material, whether full or empty—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Pounds.				*Per cent.*
.....	30 per cent	.....	$461,209	$138,362.70	.....	30.00
	Duty remitted, sec. 23.	.....	816	.....	.....	.....
	30 per cent less 20 per cent.[1]	.....	50	12.00	.....	24.00
.....	30 per cent	.....	425,243	127,572.90	.....	30.00
	Duty remitted, sec. 23.	.....	2,454	.....	.....	.....
	Free[2]	.....	500	.....	.....	.....
	30 per cent less 20 per cent.[1]	.....	243	58.32	.....	24.00
.....	30 per cent	.....	496,420	148,926.00	.....	30.00
	Duty remitted, sec. 23	.....	2,611	.....	.....	.....
	30 per cent less 20 per cent.[1]	.....	382	91.68	.....	24.00
.....	30 per cent[3]	.....	114,979	34,493.70	.....	30.00
	20 per cent[4]	.....	344,863	68,972.60	.....	20.00
	20 per cent less 20 per cent.[1]	.....	1,343	214.88	.....	16.00
	Free, Sec. IV, J5[5]	.....	6,466	.....	.....	.....
	Free, Sec. IV, M[6]	.....	1,265	.....	.....	.....
.....	20 per cent	.....	222,371	44,474.20	.....	20.00
	20 per cent less 20 per cent.[1]	.....	3,167	506.72	.....	16.00
	Free, Sec. IV, M	.....	1,373	.....	.....	.....
.....	20 per cent	.....	242,088	48,417.60	.....	20.00
	20 per cent less 20 per cent.[1]	.....	685	109.60	.....	16.00
.....	20 per cent	.....	232,937	46,587.40	.....	20.00
	20 per cent less 20 per cent.[1]	.....	1,280	204.80	.....	16.00
.....	20 per cent	.....	152,000	30,400.00	.....	20.00
	20 per cent less 20 per cent.[1]	.....	1,716	274.56	.....	16.00
.....	20 per cent	16,940	151,640	30,328.00	$8.95	20.00
	20 per cent less 20 per cent.[1]	1	11	1.76	11.00	16.00
.....	20 per cent	.....	535,156	107,031.20	.....	20.00

city treaty with Cuba.
Philippine Islands.
o Oct. 3, 1913, under act of 1909.
1913, to June 30, 1914, under act of 1913.

[5] For construction and equipment of vessels.
[6] For manufacture in bonded warehouse and export.
[7] Calendar year.

Radiators and house-heating boilers [1]*—Domestic exports.*

Exported to—	Fiscal year— 1911		1912		1913	
	Pounds.		*Pounds.*		*Pounds.*	
France	23,670	$612				
Germany	56,466	1,690	69,897	$2,217		
Norway	800	20	36,540	1,242		
Italy	23,400	621	38,103	1,214		
United Kingdom	498,209	16,839	211,780	8,031	117,924	
Canada	6,181,261	201,989	7,639,921	250,552	17,979,013	6
Mexico	160,485	5,477	48,901	1,606	236,644	
Newfoundland and Labrador	41,016	1,170	145,319	4,889	7,166	
Cuba	600	15	2,473	114		
Argentina	64,698	1,535	26,553	657	12,681	
Chile			18,683	556		
China	72,135	2,066	74,750	2,157	22,300	
Chosen	17,812	421	371,325	14,012	72,032	
Japan	892,883	21,341	539,135	13,079	677,381	
New Zealand	17,922	538			17,607	
British South Africa	5,160	129	1,300	45	16,151	
All other	529,174	14,191	213,129	6,514	138,843	
Total	8,585,691	268,654	9,437,759	306,895	19,297,742	7

Exported to—	Fiscal year— 1914		1915		1916	
	Pounds.		*Pounds.*		*Pounds.*	
France					337,715	$1
Germany	16,684	$490				
Norway			1,750	$60		
Italy			4,435	133	450	
United Kingdom	258,000	11,831	146,328	7,641	1,046,446	1
Canada	11,445,337	401,980	5,230,502	180,640	2,813,120	11
Mexico	10,690	417	6,250	294	80	
Newfoundland and Labrador	5,653	145	75,833	2,246	40,980	
Cuba	550	15	1,200	24	17,849	
Argentina			14,625	361	470	
Chile			4,000	80	31,801	
China	72,268	2,945	45,432	1,520	168,653	
Chosen			34,060	1,199	166,032	
Japan	433,460	11,755	294,791	7,957	192,706	
New Zealand					13,400	
British South Africa	336	8			28,464	
All other	3,963	134	118,993	4,690	434,998	1
Total	12,246,941	429,720	5,978,199	206,845	5,293,144	21

Exported to—	Fiscal year— 1917		1918		Calendar year 19	
	Pounds.		*Pounds.*		*Pounds.*	
France	2,018,014	$71,247	198,690	$9,447	2,726,480	$15
Norway	1,189,724	55,876	444,400	17,901	190,757	1
Italy	19,614	1,066	1,715	95		
United Kingdom	276,459	10,623	48,643	2,123	503,169	3
Canada	2,700,874	163,201	2,255,590	165,644	2,692,764	22
Mexico	1,811	142	3,743	497	87,845	
Newfoundland and Labrador	34,360	1,682	39,534	2,680	82,409	
Cuba	5,420	338	18,599	1,173	6,680	
Argentina	43,045	2,672	101,423	6,518	146,872	1
Chile	111,425	5,789	250,323	16,413	141,112	1
China	864,407	55,370	1,184,504	65,033	1,345,564	10
Chosen	31,765	1,650	2,201	130	45,724	
Japan	1,907,779	104,882	1,498,583	139,457	1,858,912	13
New Zealand			1,630	200	15,974	
British South Africa					24,303	
All other	1,426,454	63,641	328,171	24,364	501,499	3
Total	10,721,151	538,179	6,366,749	451,675	10,430,064	77

[1] Included in "All other manufactures of" prior to 1911

Engines, and parts of: Parts of boilers[1]*—Domestic exports.*

Exported to—	Fiscal year 1918.	Calendar year 1919.	Exported to—	Fiscal year 1918.	Calendar year 1919.
nce	$66,183	$98,716	China	102,712	686,487
ted Kingdom	35,972	22,768	British India	88,613	110,598
ada	714,136	884,945	Japan	806,883	1,109,063
ico	255,196	541,383	Philippine Islands	26,012	379,898
a	837,874	1,268,393	Portuguese Africa	27,438	.....
entina	186,388	128,775	All other	419,581	571,168
il	122,400	288,920			
e	66,003	137,304	Total	3,806,302	6,361,229
a	50,911	132,811			

[1] Included in "All other engines and parts of," prior to 1918.

Court and Treasury Decisions.

A barrel-shaped drum is a *cylindrical vessel*, and strong sheet-iron ums, of such shape or tubular, containing binoxide of barium, th containers available for further use as receptacles, come within is provision. (United States *v.* Bene, 6 Ct. Cust. Appls., 523, of 16.) *Cylindrical iron drums* for dioxide barium, capable of further e, also come within this provision and are not exempt from duty usual containers. (Abstract 38662, of 1915.) The provision for lindrical or tubular tanks or vessels is not limited to vessels com-sed of iron or steel exclusively, but includes those made of copper other metal. (T. D. 30229, of 1909.) The duty is laid upon e containers and not upon their contents, regardless of whether e contents bear duty or are free of duty. The containers must be de, in part at least, of metal and of such strong and permanent nstruction that upon being emptied of their contents may be perly devoted to further similar use and possess appreciable value such use. Strong iron drums, containing sulphide of sodium ich may be removed without destroying the drums as containers, l within this provision, but drums which are destroyed in removing e contents and small tin cans containing tomatoes or tomato ce, are not within this provision. (United States *v.* Gasenheimer, Ct. Cust Appls., 520, of 1916; United States *v.* Marx, 1 Ct. Cust. pls., 152, of 1911; United States *v.* Garramone and United States Braun, 2 Ct. Cust Appls., 30, 57, of 1911; Marx *v.* United States d Colby *v.* United States, 3 Ct. Cust Appls., 94, 234, of 1912.) *und tins* about the size of an ordinary barrel and packed in wooden ums fortified with iron, or in barrels or casks, the usual contain-of hydrosulphite of soda, were held dutiable under this paragraph at the same rate as their contents under paragraph R, Section III, cording to whether usable again or destroyed in the removal of eir contents. (United States *v.* Murphy, 9 Ct. Cust Appls., 248, 1919.)

Tanks or vessels of iron and steel—Rates of duty.

of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
09	151	* * * cylindrical or tubular tanks or vessels, for holding gas, liquids, or other material, whether full or empty.	30 per cent ad valorem.
13	127	* * * cylindrical or tubular tanks or vessels, for holding gas, liquids, or other material, whether full or empty.	20 per cent ad valorem.

[1] Not specially mentioned in prior acts.

Boilers of iron and steel—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, speci and ad valorem.
1883	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	45 per cent ad valore
1890	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	Do.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad valore
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	45 per cent ad valore
1909	199	Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	Do.
1913	167	Articles or wares not specially provided for in this section; * * * ; if composed wholly or in chief value of iron, steel, * * * and whether partly or wholly manufactured.	20 per cent ad valore

UNITED STATES TARIFF COMMISSION
WASHINGTON

ARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 128, 129, 130, AND 131 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

CUTLERY, FILES, AND AXES

graph 128:
Penknives, Pocket Knives, etc.
Razors.

graph 129:
Swords and Sidearms.

Paragraph 130:
Table and Other Cutlery.

Paragraph 131:
Files, Rasps, and Floats.

Paragraph 167:
Axes.

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PREFACE.

This is one of a series of tariff information surveys prepared by the nited States Tariff Commission and transmitted to the Committee Ways and Means. The series covers all of the articles and com- odities provided for in the tariff act of October 3, 1913, and others t specifically provided for. It is arranged in the numerical order paragraphs of that act.

In some cases two or more paragraphs have been combined in one mphlet. In doing this, industrial relationship of the articles has en followed when possible. In those instances where a paragraph s been treated under a preceding paragraph of the tariff act, ref- ence is made to this fact at the point where the paragraph appears numerical order. Where one grade of an article is dutiable and other grade of the same article is on the free list, the article is scussed under the dutiable paragraph which appears first in numer- l order in the tariff act. In certain instances articles of close lustrial relationship and which occur in separate paragraphs of tariff act have been combined under one paragraph for con- nience of discussion. Reference is made to this fact at the point ere the commodities would naturally occur in numerical order.

The first pamphlet in the series is an "Introduction and Index," ich contains:

1. An introductory chapter discussing the scope of the series and general method of treatment.

2. An alphabetical index of the articles provided for in the tariff of 1913, showing the paragraph of the act in which the article is pro- ed for and, if discussed under a different paragraph, the number such paragraph.

3. A list of the pamphlets in the series, showing the paragraphs and icles included in each pamphlet.

Thus by use of this "Introduction and Index" the exact location the discussion relating to a given article or commodity can be ertained.

In the preparation of this report the Tariff Commission had the vices of J. B. Hubbard, L. A. Rufener, and H. J. Bierman of the tals Division of the Commission's staff, and of others.

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CUTLERY.

SUMMARY.

The production of cutlery in the United States was valued at 20,600,000 in 1914, imports $2,900,000, and exports $1,150,000. he industry is largely concentrated in Connecticut, New York, and assachusetts, with factories in other of the Eastern States.

Our chief competitors in the home markets are Germany, the nited Kingdom, and France. Importations from these countries e, in general, competitive with the American articles, and have en most successful in both the cheapest and the very best grades. Judged by the ratio which imports bear domestic production, reign competition is greatest in pen and pocket knives, scissors and ears (31 per cent of production); important in razors (9.4 per cent); d less important in table and other cutlery.

SECTION A.—PEN AND POCKET KNIVES.

The production of pen and pocket knives in 1914 was $4,177,000, per cent of the total cutlery production. Imports for the fiscal ar 1914 were $1,300,000. Exports (not specified in the statistics) re very small. The industry does not supply the total domestic nsumption.

The foreign knives sold on the American market fall roughly into o classes—the very best grades (especially of penknives) and the y cheapest. The American manufacturer has not been suc- sful in the production of the latter grade. In heavy, medium de knives the American manufacturer holds the market.

Germany supplied 80 per cent of the imports during the three ars ended June 30, 1914, and the United Kingdom 16 per cent. e average value of the knives imported from the latter country s over twice that of the German. The advantage of the German lustry lies in its concentration at Solingen, and the fact that the fac- ies specialize in the different parts which go to make up the knife, tead of each factory making the entire knife. This organization ables the Germans to put out a very cheap knife. In the best des, the cheapness and high skill of the hand labor used give m an advantage over the American producer. English industry s the latter advantage over ours.

The industry has resisted the introduction of automatic machine ocesses, and therefore remains dependent on highly skilled labor ich is paid much less in proportion to common labor in Germany an in this country. With the large and well-established factories this country scattered and not to any great extent specialized, re is no hope of overcoming, in the immediate future, the advantage concentration and specialization which is found in the industry at lingen. Thus these advantages seem permanent.

Importations thus promise to continue in the cheapest and best grades under any conceivable rate of duty. The lowering of the rates from compound rates equivalent to 77 per cent ad valorem under the act of 1909 to ad valorem rates equivalent to approximately 50 per cent under the act of 1913, gave promise, prior to the war, of increased revenue because of increased importation.

SECTION B.—RAZORS.

The production of razors—straight and safety—was $5,037,000 in 1914, 24 per cent of the total cutlery production. Imports and exports were approximately equal, each amounting to a little over $470,000. Imports have consisted largely of straight razors, while both straight and safety razors have been exported. The domestic production exceeds consumption in safety razors, but not in straight razors.

As is the case with pocket knives, the imports of razors fall into two distinct classes—very cheap razors—those valued at $1 and less per dozen form one-half of the imports—and those of the very best quality. The best German and English razors have a long-established reputation for superiority, resting on the great technical proficiency which has been attained by the industries at Solingen and Sheffield, and involving highly skilled labor. The manufacture of a razor is a difficult process, on account of the extremely thin edge and broad back. Since the decrease of imports resulting from the war, the American manufacturers have produced a razor of comparable quality and only slightly higher price.

The Germans have developed mechanical grinding to a high degree of perfection, giving an advantage in the very cheapest grades. These are not made in the United States.

The act of 1913 reduced duties from compound rates equivalent to 71 per cent ad valorem (act of 1909) to ad valorem rates equivalent, on total imports, to 49 per cent. Increased imports, prior to the war, gave promise of a somewhat similar amount of revenue to that raised under the preceding act.

SECTION C.—SCISSORS AND SHEARS.

The production of scissors and shears in the United States in 1914 was $2,509,000, 12 per cent of the cutlery production for that year. Imports were $775,000, 31 per cent of the production. Thus domestic production does not supply domestic consumption.

The position of the United States in the manufacture of these two articles is markedly different. In shears, domestic goods hold almost the entire market, and the American shears are widely exported. Some cast scissors also are manufactured, and a number of these is exported. In forged scissors, on the other hand, German goods have had almost the entire market. Japan has become a factor upon the market recently, sending 84 per cent of the value of the imports in 1918.

Automatic machine processes have not been developed in this country to take the place of skilled labor. This fact places the American manufacturer at a disadvantage. The product is one demanding a large variety of patterns, and small, and often delicate,

gings. In this, again, the German industry has, as in the manufacture of pen and pocket knives, an advantage arising from the fact that the concentration and specialization of industry enables it to turn out cheaply products in the great variety demanded. One attempt to manufacture forged steel scissors in this country has shown labor cost above the German selling price. Import under present technical conditions thus seems permanent.

SECTION D.—SWORDS AND SWORD BLADES.

Only import statistics are available. These have been very small, averaging $18,600 per year under the act of 1909 and considerably less since the act of 1913 went into effect. Eight firms are engaged in the manufacture of these articles. There seems to be no good reason for specifying these articles separately, rather than letting them fall under manufactures of metal.

SECTION E.—TABLE AND OTHER CUTLERY.

This section covers (1) table cutlery, (2) various knives, and (3) the miscellaneous articles, as scythes, sheep shears, clippers, and razors. It does not include plated ware. The latter has been especially well fitted to American methods of production, and its use has to a large extent displaced steel cutlery. The production of table and other cutlery in 1914 was $8,863,000, 43 per cent of the total cutlery production. Imports were $333,600, 4 per cent of the production. Export statistics include scissors and shears and pen and pocket knives with other cutlery, and are therefore incomparable with both import and production figures. Exports of table cutlery were $169,000, imports $260,000. In table cutlery, then, the United States does not fully supply the domestic market. In other articles in which automatic machinery is not applicable (as it is to clippers, for instance) the same statement may be made.

During the three fiscal years just preceding the recent war, the United Kingdom sent slightly more "other" [1] cutlery than Germany; together, they furnished 78 per cent of the imports. France was next in importance as a source of imports. Since 1914 the United Kingdom, France, and Japan have been the principal contributing countries.

An analysis of the imports of Canada, Argentina, and Chile prior to the war shows that the United States was stronger in the rougher articles—scythes, sheep shears—and in barber's clippers, than in table cutlery or knives. In table cutlery, the United States furnished a smaller percentage of these imports than the United Kingdom each of these countries, and less than Germany except in the case of Canada. France furnished more than the United States in Argentina. Twenty per cent of the Canadian imports, seven per cent of the Chilean imports, five per cent of the Argentina imports are from the United States.

[1] Including table, excluding cutlery treated in previous sections, except swords

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Cutlery (total)—Summary table.

Year.	Domestic production.	Imports for consumption.[1]	Domestic exports.[1]	Ratio to production.		Value (imports for consumption).	Amount of duty.	Actual or equivalent ad valorem rate.
				Imports.	Exports.			
				Per cent.	*Per cent.*			*Per cent.*
1910		$1,817,210	$906,683			$1,817,210	$1,180,145	64.94
1911		1,924,414	1,083,891			1,924,414	1,263,974	65.69
1912		2,037,575	1,162,203			2,037,575	1,332,993	65.42
1913		1,979,245	1,142,148			1,979,245	1,246,232	62.96
1914	[2] $20,397,000	2,899,356	1,147,995	14.08	5.57	2,899,356	1,257,077	43.36
1915		2,046,500	1,682,068			2,046,500	828,890	40.50
1916		688,803	4,250,637			688,803	269,634	39.13
1917		317,986	4,777,655			317,986	116,414	36.61
1918		317,217	5,881,207			317,217	118,446	37.34
1918 [3]		346,402	5,236,904			346,402	135,682	39.17
1919 [3]		468,745	10,137,027			468,745	184,408	39.34
1920 [3]		1,886,581				1,886,581	796,539	42.22

[1] Fiscal year ending June 30. [2] Calendar year.

TARIFF PARAGRAPHS, ACT OF 1913.

General Information.

Paragraph 128.—Penknives, pocketknives, clasp knives, pruning knives, budding knives, erasers, manicure knives, and all knives by whatever name known, including such as are denominatively mentioned in this section, which have folding or other than fixed blades or attachments, and razors, all the foregoing, whether assembled but not fully finished or finished; valued at not more than $1 per dozen, 35 per cent ad valorem; valued at more than $1 per dozen, 55 per cent ad valorem: *Provided*, That blades, handles, or other parts of any of the foregoing knives, razors, or erasers shall be dutiable at not less than the rate herein imposed upon the knives, razors, and erasers, of which they are parts. Scissors and shears, and blades for the same, finished or unfinished, 30 per cent ad valorem: *Provided further*, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die-sunk conspicuously and indelibly on the blade, shank, or tang of at least one or, if practicable, each and every blade thereof.

Paragraph 129.—Sword blades, and swords and side arms, irrespective of quality or use, in part of metal, 30 per cent ad valorem.

Paragraph 130.—Table, butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable, fruit, cheese, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', palette, artists', and shoe knives, forks, and steels, finished or unfinished, without handles, 25 per cent ad valorem; with handles, 30 per cent ad valorem: *Provided*, That all the articles specified in this paragraph, when imported, shall have the name of the maker or purchaser, and beneath the same the name of the country of origin indelibly stamped or branded thereon in a place that shall not be covered thereafter.

DESCRIPTION.

articles covered by the tariff of 1913 are (1) penknives and
nives, clasp knives, pruning knives, budding knives, erasers,
re knives, and all folding knives; (2) razors; (3) scissors and
(4) sword blades, swords and side arms, and (5) certain
d knives, forks, and steels. The five sections of the catalog
ach of these classifications respectively.
[1] and saws, among the articles traditionally classed as cut-
e specified in the act, and receive separate treatment. Sheep
pruning shears, clippers of various kinds, cigar cutters,
and sickles are not specified in the act. Such articles are
d under section "E" of this unit.

DOMESTIC PRODUCTION.

cutlery industry in 1914 employed over 12,000 wage earners,
importance arises from the widespread use of its products.
rials.—Steel, because of its capability of being tempered so
can be ground to and keep a cutting edge, is the preeminent
l in the manufacture of cutlery. Recently mild steel has
loyed with 12 or 13 per cent of chromium to form "stainless
an alloy which is very resistant to rust.
best steel used is shear steel, made by welding and forging
steel produced by roasting iron of great purity with charcoal.
e, open hearth, and Bessemer steels are all used, depending
ie grade of product manufactured. Even cast iron has been
lthough its products can hardly be regarded as legitimate

rtion of the steel used in the United States prior to the war
ported from Sheffield, England. Some rough forged blanks
so been imported, to be ground and assembled here.
iandles a great variety of materials are used. The precious
mother of pearl, shell, ivory, deer horn, rubber, bone, cellu-
arious imitations of these substances, and a variety of metals
mpositions are used. Some of these materials are not pro-
a this country and require importation.
quantities of brass and other metals are used in the assem-
blades and handles.
materials, to some extent imported, enter the United States,
ws:

ks	20 per cent ad valorem.
de by crucible, electric, or cementation process	15 per cent ad valorem.
-pearl and shells, not manufactured	Free.
l parts of	Free.
ivory	Free.

ment.[2]—Equipment is of American manufacture.
od of production.—In general, the manufacture of cutlery con-
forging and grinding the blades, making the handles, and
ing these parts into the completed articles. For the forging
s rolling or casting is sometimes substituted. The following
give the processes for the different articles in greater detail.

arate survey on files accompanies this report.
ete list of the equipment of the Walden Knife Co. (in 1916) is given in the General Electric
l. 19, pp. 81-85, January, 1916.

The introduction of automatic machinery in cutlery manufac has proved difficult on account of the great variety of the produ and the difficulty of obtaining a cutting edge by the use of mechan grinding only. In general, the products have not been susceptible standardization; great variety has been demanded to meet individu tastes. The effort to adopt machine processes in the United Sta has resulted in modification of the product:

> The standard American table knife is a rigid, metal-shape handle and blade in one piece, the whole being finished by electroplating—an implement eminently suited to factory production. The razor was less readily adaptable, but the solution was found, nevertheless; and a world-wide demand has been created for the safety razor, in which hand forging and hand grinding are both practically eliminated.[1]

In the United States the industry is a factory industry, while there is much outwork in Europe. Germany, where the factory system is most advanced, presents an efficient combination of outwork and factory work. It is necessary to rely to a great extent on skilled labor in all countries, because of the resistance which the manufacture of these products presents to the advanced machine processes. Woman labor is used to some extent in England.

Organization.—The cutlery industry is one of a large number of establishments, many of them small. According to the census of 1914, over three-fourths of the 252 establishments making cutlery and edge tools each produced less than $100,000 worth in that year; the total product of these establishments formed 17 per cent of the whole. 56 per cent of the total production was made in 58 establishments producing from $100,000 to $1,000,000; 27 per cent by three establishments producing more than the above figure. The capital of the industry is given as $35,666,000; 57 per cent of the establishments, making 94 per cent of the product, were corporations.

The difficulty of the adoption of the processes of large-scale production in the industry has thus resulted in the survival of many small establishments. The American industry has been most successful, however, where it has been able to apply such processes.

Geographical distribution.—The manufacture of cutlery and edge tools is concentrated mainly in Connecticut, New York, and Massachusetts. New Jersey, Pennsylvania, and Ohio are also important producing States. The first three made over 65.5 per cent of the value produced in 1914. The largest producer—Connecticut—has been losing relative to New York during the decade and a half since 1899.

The location of theindustry may be explained by its early start in Connecticut and New York, nearness to market, and availability of raw material and labor.

History.—The first American cutlery factory was started in Worcester, Mass., in 1829. A table-cutlery factory was started at Saccarappa, Me., in 1832. Later many laborers came from Sheffield and started cutlery manufacture in Connecticut. A number of these workmen went later to Walden, N. Y.

The development of the industry has been away from hand processes and toward standardized goods. Table cutlery has proved adaptable to American methods. The manufacture of straight razors by other than hand methods has proven generally impracticable, and a machine product—the safety razor—has been developed.

[1] G. I. H. Lloyd, The Cutlery Trades, 1913, pp. 394-395.

ie most recent development has been the use of stainless steel—
nglish invention—especially in the manufacture of table cutlery.
material is now on sale in the United States.
omestic production and consumption.—The production of cutlery
914 was over 20.5 millions of dollars, imports 2.9 millions, exports
illions, imports thus forming 14.1 per cent of production, exports
per cent. The relation between imports and exports shifted dur-
the war; in 1917 the former were less than one-third of a million,
latter were over four and three-quarters million dollars.
n the different lines of cutlery the position of the domestic manu-
urer differs greatly. Only 20 per cent of the production of
lery in the United States in 1914 was pen and pocket knives,
le they formed 40 per cent of the imports of cutlery, 1912–1914.
ilarly, scissors and shears formed 12 per cent of the production,
f the import; other cutlery, 43 per cent of the production, 16 of
import; razors, 24 per cent of the production, 18 of the imports.
se figures are indicative of the position of the United States
ufacturers in these branches. A direct comparison of import
production is made for each of these classes of articles in the
owing sections.
utlery is thus an article in which the American manufacturers
e not fully supplied the needs of the United States, although at
same time there has been an export trade of over $1,000,000.
explanation of these conditions lies in the great multiplicity of
ducts, some imported, some exported; in the difference in grades
le, the United States specializing medium grades, and being less
to meet foreign competition in the finest (England, Germany,
nce) or cheapest grades (Germany); and in the importance of a
-established reputation in the manufacture of cutlery, as that
h attaches to Sheffield or Solingen goods, which gives a sale to
rtain extent independent of price and of the competition of
ls of equal quality but of less reputation.
ne disadvantage limiting the production of the American factories
in the nature of these articles, which require for their manufac-
an extensive use of skilled labor, which is paid a higher wage,
mparison to unskilled labor, in the United States than in Europe.
arently machinery is incapable of completely performing some
he necessary processes in the manufacture of many articles of
ery, so that the disadvantage of the American manufacturer
prove as permanent as will be the wider differential between
ed and unskilled labor in the United States than in Europe.
omestic exports.—Exports during the fiscal years 1911–1914,
e still unaffected by the recent war, were something over $1,000,-
annually. Since 1914 they have increased, reaching $4,750,000
917. These exports were well scattered: The United Kingdom
the largest amount prior to the war; Canada, the second largest;
ther, they took somewhat less than one-third of the export;
zil and Argentina follow, taking together about one-sixth; and
many, Australia, Cuba, and British India account for one-fifth
veen them.
he changes in direction of exports which have taken place since
beginning of the war may be best judged by the exports to the
rent continents. For the five fiscal years 1910–1914, North
erica received an average of $320,000 yearly, Europe $310,000,

South America $260,000. During the three following years, 1915-1917, Europe took $1,800,000, North America $830,000, and South America $310,000. The prices for the last three years were, of course, at a higher level, North America, previously taking a larger amount than Europe, took less than one-half of Europe's import in these three years (1915–1917), and South America, taking an amount equal to five-sixths of that sent to Europe in 1910–1914, took approximately one-sixth of the amount sent to Europe in 1915–1917.

In the two fiscal years prior to the recent war, 1913 and 1914, 37 per cent of the exports consisted of razors, 16 of table cutlery, and 47 of pen and pocket knives (very small), scissors and shears, and other cutlery. The great increase in export during the following years has been accompanied with a slight change in these proportions. For the four years 1915–1918, 44.5 per cent of the value of the exports were razors, 10 per cent table cutlery, and 45.5 pen and pocket knives, scissors, and shears, and other cutlery.

FOREIGN PRODUCTION.[1]

The chief foreign producers are Germany, the United Kingdom, and France. In Germany the industry is concentrated at Solingen, and at Sheffield in England. In France the industry is more scattered, there being several centers where cutlery is made.

The output of Solingen has been estimated at $10,000,000 yearly prior to the war—two-fifths of the value of the output of the United States in 1914—while the foreign trade of the United States (1909–10) was only a slightly greater fraction of the German foreign trade.

The strength of the German industry lies in its concentration at Solingen, and the great development of specialization in the industry which has accompanied this concentration. The numerous parts which go to make up the finished product are each the product of a separate factory, and are merely bought and assembled by the final manufacturer. The advantage of this arrangement lies in the fact that the demand for great variety can be more easily met by the highly specialized factory, manufacturing only one product, and that duplication of plant, such as takes place when each plant makes all its parts (as in the United States), is avoided. A second advantage lies in the fact that the industry, being long established and concentrated, has command of skillful labor in the immediate vicinity of the establishments which desire it.

The organization of the industry is likewise one which gives great efficiency in production. The factory system has been extended to those branches in which it is effective, and combined with outwork for many of the processes. In forging, and in finishing, the factory is predominant, while in grinding and other processes outwork remains. Outwork has been moderized by the extensive development of electric power and the installation of electric motors to furnish power in the homes of the workers.

These conditions make the German competition especially formidable in the very cheapest form of goods—where the assembling of the materials forms a heavy percentage of the cost—and in the highest quality articles, requiring the most skillful hand labor.

[1] G. J. H. Lloyd, The Cutlery Trades, p. 351–391; Auxiliary file, interview with Mr. W. S. Van Sig; and elsewhere.

itish production in 1907 was valued at $6,983,000, or approxi-ly one-third of the value of the production in the United States 09, while the foreign trade of the United States (1909–10) was alf of that of the United Kingdom. The British cutlery has a tation for superior quality, and our imports from the United dom are of high-grade articles. A larger percentage than is the with the imports from Germany and France is formed by other ry (not pen and pocket knives, razors, scissors, and shears).

the English industry highly skilled hand labor has persisted and naintained the quality of the articles produced. War necessities tended to break down the extreme conservatism in organization heffield, and there has been an extension of machine processes, ion of labor (i. e., placing unskilled men on skilled jobs formerly rmed by skilled men), and large scale organization. Another it development has been the introduction of stainless steel, which ing used to a rapidly increasing extent.

nch cutlery has been noted for great individuality of product. esses of manufacture vary widely from the factory system to the licraft, according to the locality in which the cutlery is made.

reign trade of the principal producing countries.—The relative ion of the three chief competitors for the world's markets may dged by their foreign trade statistics. For the three years 1909–, the total foreign trade of Germany in cutlery averaged $6,204,-yearly, 98 per cent of which was export, 2 import; that of the ed Kingdom $4,571,000, 82 per cent export, 18 import; of the ed States $2,790,000, 34 per cent export, 66 import; France 6,000, 89 per cent export, 11 per cent import. In exports, the tries rank: Germany, the United Kingdom, France, the United s. In imports: The United States, the United Kingdom, France, nany. The imports into the United States are approximately le the exports; the imports into the United Kingdom are one-h the exports; into France, one-eighth; into Germany, one-seventh.

the imports of certain cutlery articles into Canada, the United s furnished 21 per cent; into Chile, 16 per cent; into Argentina, cent. Over 70 per cent of the imports into each of these three ets were from Germany and the United Kingdom.

e classifications of the different countries are not of sufficient arability to make a detailed statement as between the different es of cutlery possible. In general, the position of the United es is strongest in shears and razors, weakest in pen and pocket-es. In a few of the minor articles, it furnished the bulk of the rt—sheep shears into Argentina, barber's clippers into Chile, scythes into Canada.

IMPORTS.

nount.—During the fiscal years 1910–1914 imports of cutlery d from $1,800,000 to $2,900,000. The latter amount was im-d in 1914. Imports fell off markedly after the outbreak of the amounting to only a little over $317,000 in 1918. There was increase after the war.

rieties.—Pen and pocket knives formed 42 per cent of the im- for consumption, 1910–1918. The imports of shears and scis-(predominantly the latter) formed 28 per cent during the first years of this period, and 27 per cent during the last four years.

Razors formed 18 per cent and 13 per cent of the imports for the two periods, respectively; table and other cutlery, 12 per cent and 18 per cent. Swords and sword blades formed less than 1 per cent of the imports.

Source.—During the fiscal years 1910–1914, 76.5 per cent of the imports came from Germany, 18 per cent from the United Kingdom, and 3 per cent from France. During the next three years, Germany likewise led, furnishing 68 per cent of the imports; the United Kingdom supplied 25 per cent, and France 3 per cent. The proportion furnished by Sweden and Japan increased, the latter sending 1.2 per cent during the last period. Japan alone of the countries just named sent a larger value per year for the last period.

The countries exporting to the United States show predominance in different lines. In the three fiscal years 1912–1914, approximately 41 per cent of the imports from Germany and the United Kingdom were pen and pocket knives, while they formed only 4.5 per cent of the imports from France. Eighty-one per cent of the imports from France were other cutlery (largely table, kitchen, and other knives) which formed 31 per cent of the imports from the United Kingdom and only 6 per cent of those from Germany. Razors and scissors and shears form over one-half of the cutlery imports from Germany, one-fourth from the United Kingdom, and one-seventh from France. During the next three years (1915–1917) these proportions were not greatly changed, the proportion of pocket cutlery sent from Germany and of other cutlery from England and France increasing. Japan has become a factor on the market; 74 per cent of her cutlery exports to this country were shears and scissors, and they formed 84 per cent of our total imports of scissors and shears in 1918.

Nature.—Imports have been continuous, and though varying from year to year have maintained about the same yearly average since 1885. This has meant, of course, that they have formed a smaller and smaller percentage of an increasing consumption. The import is general, not local. It is made up of very cheap cutlery, not produced here, and of the very best grades, in which the European industry has the advantage of inherited skill and the use of hand processes which would be uneconomical in this country.

Revenue.—Under the act of 1909 the revenue from the duties levied upon the cutlery products specified averaged for the years 1911–1913 $1,281,000, equivalent to 65 per cent of the value of the imports. The ad valorem equivalent of the rates of the preceding act had been approximately equal to this, and under it revenue had increased with increasing imports. Larger imports had come in under the lower duties of the acts of 1883 and 1894.

The act of 1913 provided ad valorem duties equivalent, on total imports, to somewhat less than 40 per cent. Under this act revenue has fallen off with the decreasing imports, which have been one of the effects of the war. Whether the lower duties would have increased imports sufficiently to bring in the same or a larger revenue is obscured by the effects of the outbreak of the war. During the three quarters prior to the war (to June 30, 1914), while the act of 1913 was in force, imports were at a yearly rate of $3,377,000, the revenue at the rate of $1,384,000. This is a larger revenue than the average under the act of 1909 for the three years given. It is problematical, however, whether such a rate would have been maintained. In the pas

ɜed duties have meant increased imports even to the extent
eased revenue.
petitive conditions, tariff history, and tariff considerations are
l under the separate sections.

Cutlery and edge tools[1]*—Production in United States (calendar year).*

[From Federal census.]

ɜe.	1899[2]		1904		1909		1914	
	Quantity.		Quantity.		Quantity.		Quantity.	
		Per cent.		*Per cent.*		*Per cent.*		*Per cent.*
ut.....	5,362,620	36.0	6,167,852	33.1	6,720,700	29.4	7,356,772	28.8
:.....	1,665,644	11.2	2,949,079	15.8	4,060,632	17.7	5,056,270	19.8
ɜetts....	2,608,075	17.5	2,584,927	13.9	4,391,424	19.2	4,354,119	17.0
ɣ.....	821,735	5.5	1,205,623	6.5	(3)	(3)	2,260,000	8.9
ɜnia....	1,212,665	8.2	2,117,603	11.4	(3)	(3)	2,256,000	8.8
.....	1,104,438	7.4	1,272,515	6.8	(3)	(3)	1,424,000	5.6
.....	2,106,301	14.2	2,317,330	12.5	7,712,158	33.7	2,833,826	11.1
l total..	14,881,478	100.0	18,614,929	100.0	22,884,914	100.0	25,540,987	100.0

ɜstable cutlery; razors, plain and safety; axes and hatchets; scissors, shears, and clippers; pocket
ɣers, bits, chisels, and planes; all other.
ɜa custom and repairing work; revised total, $14,787,355.
ɜd under "All other."

Cutlery[1]*—Production in United States.*

[From Federal census.]

r year 1914..... [2] $20,597,000

Cutlery—Production in principal foreign countries.

Country.	Value, 1907.	Value before the war.[1]
ɪgdom[2].....	$6,983,000	.....
.....	.....	$10,000,000
.....	.....	8,000,000

ɜ Boyer, The Cutlery Works of Theirs, Scientific American Supplement, vol. 79, p. 184.
ɪ of production, 1907.
ɜally total for Germany.
ɜally total for United Kingdom.

Cutlery (total)—Imports by countries (fiscal years).

ported from—	1910	1911	1912	1913	1914	1915
.....	$52,752	$58,797	$57,794	$66,964	$75,443	$37,276
.....	1,311,903	1,443,838	1,564,907	1,581,159	2,302,121	1,669,913
ɪgdom.....	380,311	421,231	356,920	331,603	411,818	294,526
ɯngary.....	41,522	40,597	33,185	26,628	49,465	29,039
.....	5,181	11,049	10,515	11,783	10,743	6,520
.....	1,035	1,499	1,205	1,772	1,555	1,847
.....	2,445	2,492	2,689	2,930	2,358	2,920
.....	7,884	13,141	7,848	3,725	7,016	15,249
ɯl.....	1,803,033	1,992,644	2,035,063	2,026,564	2,860,519	2,077,290

ɜtable cutlery; scissors, shears, and clippers; razors, plain and safety; pocket knives; other cutlery
ɜools.
ɜe duplication $329,000; one item of $3,206,029 (other cutlery and edge tools) embraces some kinds
ɜes.

Cutlery (total)—Imports by countries (fiscal years)—Continued.

Imported from—	1916	1917	1918	1919 [1]	192
France	$20,398	$24,336	$22,952	$18,711	$
Germany	333,534	27,648			
United Kingdom	255,145	202,346	151,782	117,280	1
Austria-Hungary	230				
Sweden	8,641	8,139	11,348	22,442	
Canada	622	1,124	25,681	44,418	
Japan	7,364	26,794	103,040	149,376	1
All other	7,669	28,498	8,133	6,589	
Total	633,603	318,885	322,936	358,806	

[1] Calendar year.

Cutlery (total)—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actu con ad v
						Per
1907	Specific and ad valorem.		$2,232,175	$1,437,856		
1908	do		1,976,574	1,280,013		
1909	do		1,754,112	1,118,146		
1910	do		1,817,121	1,180,145		
1910	Free		89			
1911	Specific and ad valorem.		1,923,823	1,283,974		
1911	Free		591			
1912	Specific and ad valorem.		2,037,575	1,332,863		
1913	do		1,979,245	1,246,232		
1914	do		2,899,164	1,257,077		
1914	Free		192			
1915	Various ad valorem.		2,045,073	828,890		
1915	Free		1,427			
1916	Various ad valorem.		688,801	269,634		
1916	Free		2			
1917	Various ad valorem.		317,980	116,414		
1918	do		317,205	118,446		
1918	Free		12			
1918 [1]	Various ad valorem.		346,402	135,682		
1919 [1]	do		468,745	184,406		
1920 [1]	do		1,886,581	796,538		

[1] Calendar year.

Cutlery (total)—Domestic exports (fiscal years).

Exported to—	1910	1911	1912	1913	1914	19
France	$13,151	$13,505	$30,043	$15,641	$21,518	$
Germany	63,187	52,536	36,586	65,539	75,116	
United Kingdom	137,732	205,924	264,542	200,760	250,748	7
Canada	121,265	123,231	203,507	204,322	173,539	1
Cuba	51,547	52,304	52,095	56,105	55,933	
Mexico	36,159	37,936	38,896	43,761	19,445	
Argentina	54,222	72,074	78,557	98,672	109,076	
Brazil	112,987	140,176	98,798	106,309	85,329	
British India	30,470	47,298	45,032	45,120	67,280	
Australia	[1] 44,211	72,582	57,788	58,373	52,460	
All other	241,752	257,405	256,389	245,546	237,251	4
Total	906,683	1,083,991	1,162,203	1,142,148	1,147,995	1,6

[1] And Tasmania.

Cutlery (total)—Domestic imports (fiscal years)—Continued.

Exported to—	1916	1917	1918	[1] 1918	[1] 1919
pe	$2,610,136	$1,827,692	$2,266,788	$1,337,073	$3,781,312
America	818,101	1,339,890	1,538,085	1,664,329	1,853,847
America	414,582	951,144	1,216,949	1,332,397	2,611,473
	194,789	318,528	360,588	361,970	1,038,646
ia	141,137	244,585	366,307	395,367	553,537
	71,802	95,816	132,490	145,768	298,212
Total	4,250,637	4,777,655	5,881,207	5,236,904	10,137,027

[1] Calendar year.

Imports of cutlery under various acts, selected years.

Fiscal year.	Imports.	Duties.	Equivalent ad valorem rate.
			Per cent.
1884	$1,846,105.16	$852,410.52	46.17
1885	1,448,758.73	664,935.76	45.90
1889	2,353,773.95	1,072,987.31	45.59
1890	2,525,024.24	1,139,898.25	45.14
1893	1,398,817.57	1,120,637.22	80.11
1894	739,758.30	579,104.76	78.29
1897	2,348,706.66	1,143,498.72	48.70
1899	1,191,663.52	782,844.98	65.69
1900	1,516,512.50	989,960.68	65.28
1905	1,802,735.81	1,174,080.27	65.12
1907	2,232,174.89	1,437,855.69	64.42
1909	1,754,111.65	1,118,145.57	63.74
Average 1911–1913	1,980,000.00	1,281,000.00	64.68

Imports for consumption and revenue, three quarters ended June 30, 1914.

Quarters.	Value.	Revenue.
–Dec. 31, 1913	$1,100,380	$457,577
–Mar. 31, 1914	692,517	280,494
–June 30, 1914	740,101	299,491
Total	2,532,998	1,037,562
y rate	3,377,000	1,384,000

Foreign trade in cutlery—Germany, United Kingdom, United States, and France, 1909–1911.

Countries.	Value.			Yearly average value.			Percentage of total.	
	Exports.	Imports.	Total.	Exports.	Imports.	Total.	Exports.	Imports.
ny	$18,212,000	$398,000	$18,610,000	$6,071,000	$133,000	$6,204,000	97.9	2.1
l Kingdom	11,290,000	2,423,000	13,713,000	3,763,000	808,000	4,571,000	82.4	17.6
l States	2,851,000	5,530,000	8,381,000	950,000	1,840,000	2,790,000	34.0	66.0
	4,000,000	487,000	4,487,000	1,334,000	162,000	1,496,000	89.2	10.8

Cutlery, 1910–1914, 1915–1918—Imports for consumption.

Kinds.	1910–1914		1915–1918	
	Value.	Percentage of total.	Value.	Pe
Pen and pocket knives	$4,432,613.26	41.59	$1,421,481.00	
Razors	1,935,394.02	18.16	434,867.00	
Scissors and shears	2,964,202.00	27.81	908,108.00	
Swords	94,591.62	.89	11,673.00	
Table cutlery	893,738.32	8.39	419,597.00	
Butchers', etc., knives	337,266.90	3.16	183,762.00	
Total	10,657,806.12	100.00	3,370,506.00	

Cutlery—Imports from principal foreign countries.

Kinds.	Germany.		United Kingdom.		France.		Japan.	
	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per
1912–1914.								
Pen or pocket knives	$2,283,704	41.91	$454,675	41.32	$9,010	4.50	$153	
Razors and parts of	1,128,001	20.71	99,891	9.08	2,969	1.48	393	
Scissors and shears	1,694,921	31.11	199,248	18.11	26,103	13.04	1,532	
All other	341,561	6.27	346,527	31.49	162,119	80.98	5,925	
Total	5,448,187	100.00	1,100,341	100.00	200,201	100.00	7,977	
1915–1917.								
Pen or pocket knives	1,016,662	49.6	282,811	37.6	630	.7	1,643	
Razors and parts of	325,709	15.9	47,364	6.3	2,203	2.7	429	
Scissors and shears	611,464	29.8	123,982	16.5	10,543	12.9	27,778	
All other	97,260	4.7	297,860	39.6	68,634	83.7	7,228	
Total	2,051,095	100.0	752,017	100.0	82,010	100.0	37,078	

Article.	Year.	United States.		United Kingdom.		Germany.		France.		Belgium.		Other countries.		Total.	
		Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Scythes and sickles	1912	$2,791		$27,775		$13,350		$433						[1] $44,349	
Do	1913	120		17,500		1,000		410				$650		19,680	
Total		2,911	4.55	45,275	70.70	14,350	22.41	843	1.32			650	1.02	64,029	13.34
Pocket knives	1912	50		4,295		18,341		661		$83		33		23,463	
Do	1913	30		6,230		22,730		970		620		70		30,650	
Total		80	.15	10,525	19.45	41,071	75.90	1,631	3.01	703	1.30	103	.19	54,113	11.27
Knives and forks	1912	3,557		28,632		20,749		1,421		50		64		54,473	
Do	1913	5,050		27,610		23,890		3,510		600				60,660	
Total		8,607	7.47	56,242	48.86	44,639	38.78	4,931	4.28	650	.56	64	.05	115,133	23.98
Scissors and shears	1912	[2] 30,000		14,432		36,343		3,436		372		140		[2] 84,813	
Do	1913	28,500		3,600		43,200		4,400		700				80,400	
Total		58,590	35.46	18,032	10.91	79,543	48.15	7,836	4.74	1,072	.65	140	.09	165,213	34.42
Finger-nail scissors	1912			102		745		73		6		46		972	
Do	1913	40		210		1,520		80		20				1,870	
Total		40	1.41	312	10 98	2,265	79.70	153	5.38	26	.91	46	1.62	2,842	.60
Pruning and clipping shears	1912	1,740		3,040		4,850		3,190		320				13,140	
Do	1913	130		6,200		5,680		1,260		730		2,900		16,900	
Total		1,870	6.23	9,240	30.76	10,530	35.05	4,450	14.81	1,050	3.50	2,900	9.65	30,040	6.26
Barber's clippers	1912	1,991		619		260		138		87		162		3,257	
Do	1913	450		10		200		20						680	
Total		2,441	62.00	629	15.98	460	11.68	158	4.01	87	2.22	162	4.11	3,937	.83

[1] Total of items given; in original table $43,994.

[2] Error in conversion in original table, which reads: "United States $29,725; total, $84,083."

Imports of cutlery into Chile—Continued.

Article.	Year.	United States.		United Kingdom.		Germany.		France.		Belgium.		Other countries.		Total.	
		Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Razors:															
With ivory handle	1912	.....	.....	$197	.....	$309	.....	.....	.....	.....	.....	$1	.....	$507	.....
Do	1913	$730	.....	170	.....	530	.....	$70	.....	.....	.....	80	.....	1,580	.....
Total	.....	730	34.98	367	17.59	839	40.20	70	3.35	.....	.....	81	3.88	2,087	0.44
Other	1912	738	.....	3,446	.....	10,721	.....	1,382	.....	.....	.....	31	.....	16,318	.....
Do	1913	2,540	.....	4,370	.....	16,900	.....	560	.....	$1,050	.....	90	.....	25,510	.....
Total	.....	3,278	7.84	7,816	18.69	27,621	66.03	1,942	4.64	1,050	2.51	121	.29	41,828	8.68
Blades	1912	365	.....	37	.....	.....	.....	.....	.....	.....	.....	.....	.....	402	.....
Do	1913	250	.....	20	.....	150	.....	10	.....	.....	.....	.....	.....	430	.....
Total	.....	615	73.92	57	6.85	150	18.03	10	1.20	.....	.....	.....	.....	832	.18
Grand total	.....	79,162	16.49	148,495	30.93	221,468	46.13	22,024	4.59	4,638	.97	4,267	.89	480,054	100.00

Imports of cutlery into Argentina.

[Department of Commerce, Miscellaneous Series, No. 43, pp. 12-13.]

Articles.	Year.	United States.		Germany.		United Kingdom.		France.		Belgium.		Other countries.		Total.	
		Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Cutlery, table	1913	$18,156	.....	$168,584	.....	$74,893	.....	$110,084	.....	$5,839	.....	$19,039	.....	$396,595	.....
Do	1914	8,677	.....	94,043	.....	23,624	.....	38,516	.....	3,376	.....	19,511	.....	187,747	.....
Total		26,833	4.59	262,627	44.94	98,517	16.86	148,600	25.43	9,215	1.58	38,550	6.60	584,342	46.02
Knives	1913	291	.....	87,541	.....	3,877	.....	4,120	.....	1,419	.....	1,802	.....	99,050	.....
Do	1914	69	.....	41,768	.....	2,570	.....	2,061	.....	1,150	.....	2,918	.....	50,536	.....
Total		360	.24	129,309	86.44	6,447	4.31	6,181	4.13	2,569	1.72	4,720	3.16	149,586	11.78
Razors:															
Safety	1913	5,477	.....	20,265	.....	1,065	.....	1,141	.....	69	.....	88	.....	28,105	.....
Do	1914	3,409	.....	11,169	.....	179	.....	1,296	.....	203	.....	147	.....	16,403	.....
Total		8,886	19.96	31,434	70.62	1,244	2.80	2,437	5.48	272	.61	235	.53	44,508	3.50
Other	1913	46,158	.....	125,736	.....	1,998	.....	2,976	.....	1,847	.....	2,037	.....	180,752	.....
Do	1914	2,495	.....	66,903	.....	1,123	.....	903	.....	3,792	.....	697	.....	75,913	.....
Total		48,653	18.95	192,639	75.05	3,121	1.22	3,879	1.51	5,639	2.20	2,734	1.07	256,665	20.21
Shears:															
Sheep	1913	19,643	.....	88	.....	5,308	.....	110	.....	.....	.....	.....	.....	25,149	.....
Do	1914	129	.....	.....	.....	1,663	.....	.....	.....	.....	.....	.....	.....	1,792	.....
Total		19,772	73.39	88	.33	6,971	25.87	110	.41	.....	.....	.....	.....	26,941	2.12
Other	1913	26	.....	7,982	.....	10,441	.....	351	.....	2,293	.....	2,896	.....	23,989	.....
Do	1914	27	.....	7,439	.....	7,987	.....	.....	.....	.....	.....	6	.....	15,459	.....
Total		53	.14	15,421	39.09	18,428	46.71	351	.89	2,293	5.81	2,902	7.36	39,448	3.11
Scissors and shears, n. e. s.	1913	7,450	.....	91,055	.....	2,776	.....	11,243	.....	1,752	.....	1,294	.....	115,570	.....
Do	1914	2,239	.....	36,013	.....	2,285	.....	8,828	.....	3,050	.....	416	.....	52,831	.....
Total		9,689	5.75	127,068	75.45	5,061	3.01	20,071	11.92	4,802	2.85	1,710	1.02	168,401	13.26
Total	1913	97,201	.....	501,251	.....	100,358	.....	130,025	.....	13,219	.....	27,156	.....	869,210	.....
Total	1914	17,045	.....	257,335	.....	39,431	.....	51,604	.....	11,571	.....	23,695	.....	400,681	.....
Grand total		114,246	9.00	758,586	59.74	139,789	11.01	181,629	14.30	24,790	1.95	50,851	4.00	1,269,891	100 00

Canadian imports of cutlery, year ended March 31, 1914.

Article.	United Kingdom.		Germany.		United States.		Austria-Hungary.		France.		Other.		Total.	
	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Knives, hay or straw	$184	3.6	.....	.....	$1,933	90.4	.....	.....	.....	.....	.....	.....	$5,117	0.39
Knives, edging	30	13.1	.....	.....	199	86.9	.....	.....	.....	.....	.....	.....	229	.02
Scythes	2,345	17.39	.....	.....	10,568	76.74	$766	5.56	.....	.....	[1] $44	0.31	13,773	1.06
Sickles or reaping hooks	967	72.87	.....	.....	360	27.13	.....	.....	.....	.....	.....	.....	1,327	.10
Penknives, jackknives, and pocketknives, of all kinds	63,389	64.07	$28,544	28.85	3,116	3.15	1,951	1.97	$694	0.70	1,248	1.26	98,942	7.62
Knives or forks of steel, plated or not, n. o. p.	207,809	61.04	58,957	17.32	68,355	20.08	2,829	.83	1,928	.57	531	.16	340,409	26.24
All other cutlery, n. o. p	336,707	40.64	292,389	35.29	182,240	22.00	2,350	.29	6,567	.79	8,213	.99	828,466	63.87
Bayonets, swords, fencing foils and masks	2,421	26.4	1,306	14.24	4,975	54.24	.....	.....	63	.69	406	4.43	9,171	.70
Total	613,902	47.32	381,196	29.39	274,746	21.18	7,896	.60	9,252	.71	10,472	.80	1,297,464	100.00

[1] Sweden.

PENKNIVES AND POCKETKNIVES.

SECTION A. CUTLERY UNIT.

Pen and pocket knives—Summary table.[1]

Year.	Domestic production.[2]	Imports for consumption.[2]	Ratio to production, imports.[4]	Value (imports for consumption.)[4]	Amount of duty.[3]	Value per unit of quantity.	Equivalent ad valorem rate.
		Number.	*Per cent.*			*Each.*	*Per cent.*
1910		12,642,068		$789,662	$604,164	$0.062	76.51
1911		12,196,950		804,679	624,624	.066	77.62
1912		12,489,546		811,121	630,069	.065	77.68
1913		11,911,362		724,896	547,458	.061	75.52
1914	$4,177,000		31.18	1,302,255	637,930		48.99
		Dozen.				*Dozen.*	
1915		1,040,994		1,010,264	465,548	$0.970	46.08
1916		268,896		285,878	134,654	1.063	47.10
1917		31,497		68,738	35,918	2.182	52.25
1918		26,725		56,601	29,015	2.118	51.25
1918[5]		93,494		91,741	42,313	.981	46.12
1919[5]		97,259		139,422	68,567	1.433	49.18
1920[5]		319,188		585,376	300,706	1.52	51.37

[1] Domestic exports not specified.
[2] Calendar year.
[3] Fiscal years ending June 30.
[4] Values.

General Information.

PARAGRAPH 128, ACT OF 1913.

"Penknives, pocketknives, clasp knives, pruning knives, budding knives, erasers, manicure knives, and all knives by whatever name known, including such as are denominatively mentioned in this section, which have folding or other than fixed blades or attachments, * * * all the foregoing, whether assembled but not fully finished or finished; valued at not more than $1 per dozen, 35 per cent ad valorem; valued at more than $1 per dozen, 55 per cent ad valorem: *Provided*, That blades, handles, or other parts of any of the foregoing knives * * * or erasers shall be dutiable at not less than the rate herein imposed upon the knives, * * * and erasers, of which they are parts. * * * *Provided further*, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die sunk conspicuously and indelibly on the blade, shank, or tang of at least one, or, if practicable, each and every blade thereof."

DESCRIPTION.

The essential feature of the pocketknife is that the blade folds into the handle. All such knives are included under paragraph 128. In addition, the paragraph specifies pruning knives, budding knives, erasers, and manicure knives, and these are entered under its provisions, whether folding or not. The ordinary eraser is, in fact, simply a short, light blade of peculiar shape set rigidly in a small handle. Three of the four companies listed in the "Cutlery Makers of America" as manufacturing ink erasers are pocketknife manufacturers. Pruning knives, budding knives, and manicure knives are similarly made by 19 firms, only 6 of which, however, made pocketknives.

DOMESTIC PRODUCTION.

The industry produced over $4,000,000 worth in 1914

Materials.—The chief material used in the production of pen and pocket knives is the steel for blades and springs. Crucible steel has been used for the best blades, open-hearth for those of inferior quality. Some steel was formerly imported from Sheffield, England. The recent war has necessitated the use of domestic material, and American production of higher grades of steel has followed the general restriction of imports.

The "scales" of the knife—the plates between which the blades are placed and to which the handles are attached—are usually made of brass. The handles of the knife are made of a great variety of materials, from the precious metals to wood and composition materials of great cheapness.

Equipment.—Machinery is used in forging, and to some extent in grinding. The forging and annealing of the steel require appropriate furnaces. (A list of the equipment of a modern factory, using electric drive is given in the General Electric Review, vol. 19, pp. 81-89, Jan., 1916.)

Methods of production.—There are three steps in the making of the pocket knife—the forging of the blade, the grinding, and the final assembling. The traditional method of hand forging has given way before the use of steam and trip hammers. Often the blades are simply stamped out previous to the heat treatment. When formed, the blade is hardened and tempered. The quality of the blade depends largely upon this heat treatment which requires great care and skill.

After the heat treatment the blades are straightened, and then go to the grinding process. Preliminary grinding is done by machines which hold the blades against the stone; finish grinding, by hand.

The springs are stamped out and tumbled.

The scales, which hold blades, springs, and handles together, are stamped out of sheet metal—usually brass. Machinery (not automatic) is used in the shaping of the handles, the process used depending upon the material.

The final step in manufacture is the assembling, riveting the blades and springs into the scales, and putting on the handles.

The complexity and diversity of the product have rendered it more resistent to the application of machine processes than table cutlery, for instance. The industry, as carried on in Europe, involves laborious and detailed manual adjustments. Such methods are not fitted to conditions here, and the resistance which the mechanical side of production has offered to methods of large-scale production has resulted in a portion of the American market being in the hands of the small-scale European producer.

In the United States the industry is a factory industry. At Solingen and Sheffield much of the work is done as outwork.

Organization.—Separate statistics for the organization of the pocket-knife industry are not given by the census. It is to be noted, however, that it is quite distinct as an industry, only 2.2 per cent of the total production for 1914 is made by establishments not primarily pocket-knife establishments. Some of the pocket-knife factories manufacture other products. However, the list of firms producing

pocket knives contains few names of firms producing also other kinds of knives.

The capital invested in the industry in 1914 was $5,881,000.

There exists a certain amount of trade in parts of cutlery. Somewhat less than 1 per cent of the imports under the acts of 1909 and 1913 (to June 30, 1918) was entered as parts. Such trade is more common in Great Britain, where the final manufacturer often does little more than the final assembling, buying the parts of the knife already made.

Pen and pocket knives are products not well adapted to large-scale industry. Individuality and great variety of product is demanded, while the necessity of using hand grinding to give the final cutting edge to the blade has not been obviated by mechanical devices.

Geographical distribution.—Eighteen of the 50 manufacturers are located in New York, 11 in Connecticut, 8 in Ohio, and 6 in Pennsylvania. Only one company—in Chicago—is located west of Ohio. The early start of the industry in Connecticut, whence it moved to New York, and nearness to markets and labor supply explain its location.

A noteworthy feature of the distribution of the industry is the fact that a large number of the firms are situated in small towns. Meriden, Conn., Walden and Ellenville, N. Y., are examples of such towns. There are, however, factories in the largest cities—New York, Chicago, Boston, and Providence, among others.

History.—The first American pen and pocket knife factory was founded in 1829, at Worcester, Mass. From there the industry spread into neighboring States—New York, Pennsylvania, and New Jersey.

The industry was founded by Sheffield workmen, who came with English traditions in manufacture. Sheffield steel was imported for raw material. A number of the early factories started as cooperative enterprises.

The estimate furnished by the American Pocket Cutlery Manufacturers' Association indicates that the growth of the industry has been gradual.

Domestic production and consumption.—In 1914 the production of pen and pocket knives was valued at $4,177,000, imports at $1,302,000, or 31 per cent of the production. Exports are not given in the official figures; they are small.

Domestic production is thus still insufficient to satisfy domestic consumption. One explanation is the difficulty of adjusting the manufacture of pocket knives to the methods of large-scale production which have proven efficient in other lines of American industry.

Domestic exports.—Statistics of exports are not given in Commerce and Navigation. A small amount has gone to Canada—in the year ended March 31, 1914, $3,116. In the same year Germany sent somewhat less than ten times as much and the United Kingdom over twenty. It seems safe to conclude that total exports are inconsiderable.

FOREIGN PRODUCTION.

Germany and Great Britain are the principal foreign producers of pen and pocket knives. Austria-Hungary and France are likewise important. German production has excelled in the cheapest

grades—grades not produced to a great extent in this country. English knives have been of the better grades. In the three fiscal years prior to the war (1912–1914) the value of the German knives imported was 5 times that of the English; in the next three, 14 times that of the English.

The competitive strength of these countries rests in established reputation and an advantage of skilled labor which forms a large portion of the cost of production of pocket knives. Likewise, they have had a longer experience and the advantage which comes from concentration of the industry in a single town—Sheffield, England, and Solingen, Germany. Experience is especially valuable in the heat treatment of the blades which is a delicate and important operation, and which determines the quality of the blades.

As far as the introduction of large scale factory methods has been practicable, the United States has an advantage.

In Great Britain, under the stress of war and the necessity of increased output, the tendency in cutlery manufacture has been toward larger scale production. German industry is more thoroughly a factory industry than that of Great Britain, and has the advantage, in out work, of the use of electric motors in the homes of the workers.

IMPORTS.

During the fiscal years 1910–1913 imports average slightly less than $800,000. In 1914—three-fourths of the year under the reduced duties of the act of 1913—imports were over $1,300,000, and in 1915 over $1,000,000. Since that date until the end of the war they have decreased steadily, being less than $57,000 in 1918. In 1920 (calendar year) imports had increased to $585,376.

Varieties.—Under the act of 1909 (Aug. 6, 1909 to Oct. 3, 1913) 73 per cent of the knives imported were valued at under 50 cents per dozen. These are extremely cheap knives, retailing at 5 and 10 cents apiece. They formed slightly more than 33 per cent of the value of the imports, and furnished only 22 per cent of the revenue. The next two classes ($0.50 to $1.25 and $1.25 to $3 per dozen) each formed slightly less than 25 per cent of the value of the imports and 30 per cent of the revenue. Knives valued at more than $3 comprised 17 per cent of the value imported and 19 per cent of the revenue. Assembled knives (not finished) and parts comprised but 0.03 per cent of the number imported, 0.07 per cent of the value.

Source.—These imports came principally from Germany. In the three years ended June 30, 1914, Germany supplied 80 per cent of the value of the pocket knives imported, Great Britain 16 per cent, Austria-Hungary 3½ per cent, and Sweden and France approximately one-third of 1 per cent. During the following three years, with a greatly decreased import, Germany furnished 75 per cent, Great Britain 21 per cent, Austria-Hungary 2 per cent, Sweden one-half of 1 per cent, and France only one-twentieth of 1 per cent.

In 1914 the British knives were worth over twice as much per dozen as the German. The Austrian, French, and Swedish knives were valued at somewhat more per dozen than the German.

The broader classifications of the act of 1913 show a somewhat similar distribution of imports. Seventy-two per cent of the number

knives imported under that act to June 30, 1918, and 41 per cent
he value was made up of knives valued at less than $1 per dozen.
s class furnished slightly more than 30 per cent of the revenue.
se valued at over $1 formed 28 per cent of the quantity, 58 per cent
he value, and furnished 68.5 per cent of the revenue. Assembled
es (not finished) and parts show an increase over importations
er the preceding act—one-half of 1 per cent of the quantity and
roximately three-fourths of 1 per cent of the value were formed
such articles.

haracter.—The American industry does not produce the very
apest grade of pocket knives to any extent. As far as imports
composed of these cheap grades, imports are supplementary to,
ier than competitive with, domestic industry.

mports have been continuous, and have shown no great variation
e 1900 except just after the act of 1913.

evenue.—Under the act of 1909 (Aug. 6, 1909, to Oct. 3, 1913),
revenue averaged slightly less than $600,000 per year, at a rate
ivalent to 77 per cent ad valorem. Through the last quarter
913 and the first two of the following year the rates of the 1913
were in effect. During these 9 months $556,000 in revenue was
ected at the 35 and 55 per cent rates provided by the act. Rev-
e was thus collected at a rate of $741,000 per year for this period.
ler the continuance of normal conditions imports would thus
e been high enough to offset the decreased rates, and might even
e resulted in increased revenue. Imports were curtailed by war
ditions, with a corresponding drop in revenue; in the fiscal year
s it amounted to only $29,000. In 1920 (calendar year) it had
n to $300,706.

TARIFF HISTORY.

he act of 1883 provided a 50 per cent duty on penknives and
ket knives of all kinds. In 1890, the manufacturers requested
mpound duty. The act of that year added erasers and provided
hedule according to the value of the knives, levying a specific
y varying from 12 cents to $2 per dozen, and 50 per cent ad
rem in addition. The act of 1894 more minutely subdivided
less valuable knives. It provided ad valorem duties for knives
ied at 30 cents or less, and those exceeding $3 per dozen; com-
nd on the others. These compound duties were at a less rate
n those of the former act. Unassembled parts were specified
included under the above schedule with the proviso that none
ld pay the lowest (simple ad valorem) duty. The act of 1897
ed clasp knives, pruning knives, budding knives, and manicure
es to the classification, shifted it slightly, and provided higher
valorem and lower specific duties. The following act made no
ge in rates or classification of finished knives, adding, however,
rovision for assembled but not fully finished knives. It also
ided that imported knives be stamped with the name of the
ntry of origin on one or all blades. The act of 1913 laid an
alorem duty of 35 per cent on those knives valued at not more
n $1 per dozen, and 55 per cent on those valued at more than $1.
mbled knives, not fully finished, were included under these rates.
les and other parts were made dutiable at a rate not less than
finished knives of which they were parts. The provision for

marking the name of the country of origin on the knife remained unchanged.

The result of the schedule of 1890 was to raise the duty to one equivalent to approximately 90 per cent. The rates of the act of 1894 resulted in the decrease to rates equivalent to slightly over 50 per cent of the value of the articles imported. That of 1897 again increased rates—this time to duties equivalent to over 73 per cent. Under the act of 1909, the revenue collected was equal to 77 per cent of the value of imports; under the act of 1913, providing ad valorem duties of 35 and 55 per cent, the revenue collected to June 30, 1918, equaled 47 per cent of the value of imports.

Prior to the recent war, the change from higher to lower duties, or vice versa, has been followed by an inverse change in the value of the knives imported. Even under the high rates of the act of 1909, however, there was an import of approximately $778,000 yearly. That of 1914 was over $1,300,000. Figures are lacking to make a definite comparison between these fluctuations and the amounts produced. The production of the cheap knives, however, forming the bulk of the imports, has not been undertaken to any extent.

COMPETITIVE CONDITIONS.

The most marked difference between the product of the American manufacturers and foreign knives sold upon the American market is the difference in grade. The great bulk of the imported knives are of the cheapest grade—those scheduled below 50 cents per dozen—in which the American manufacturers do not compete.[1] Under the act of 1909, such knives formed 73 per cent of the quantities imported, and 34 per cent of their value. This import is thus supplementary. Approximately $515,000 yearly fell under the higher classifications made by this act—about 12½ per cent of the value of production in 1914. Forty-two per cent of the value of the total import was valued at over $1.25 per dozen under that act; 58 per cent at over $1 per dozen under the act of 1913, to June 30, 1918.

The European manufacturers have certain advantages over the American. One of these is the reputation which has been established by Sheffield and Solingen cutlery. This factor is doubtless becoming of less importance with the decreasing share of our consumption furnished by Europe.

This reputation for superiority rests on the grade of product attainable by the long established industries in these two cities. Skillful—though not highly paid—laborers have been developed, and in the making of a product as incapable of standardization as pocket knives, this factor is an important one. The minute and skillful labor required is not as available in the United States as in Europe.

In these two chief centers the industry gains the additional efficiency of concentration, while the American industry is situated in a number of small towns.

American industry has been unable to manufacture the cheapest grades of knives, despite the high duties falling upon them. In the better grades, American knives hold the bulk of the American market. The lower duties of the act of 1913 were followed by increased

[1] Statement of a committee representing the pocket knife manufacturers, 1913.

ortations until the outbreak of the war. On foreign markets, erican pocket cutlery is of very minor importance in comparison h our chief competitors—the United Kingdom and Germany.

TARIFF CONSIDERATIONS.

he compound duties in force from the act of 1890 to that of 1909 e not, in general, fallen most heavily upon the cheapest grades knives. The equivalent ad valorem rates are set forth in the owing table, in which the highest rates under each act are starred. se highest rates fall on the classes valued at from 50 cents to 25 or $1.50 per dozen, except in the act of 1894, when the classi- tion is that valued at over $1.50 and up to $3 per dozen.

valent ad valorem rate of duty falling on the different classes of pen and pocket knives, 1894–1913.

Classification.	Acts—				
	1890 [1]	1894	1897	1909	1913
over 30 cents per dozen	.....	25	.....	.....	.....
over 40 cents per dozen	.....	.....	40	40	.....
over 50 cents per dozen	82	.....	.....	.....	.....
over $1 per dozen	.....	.....	.....	.....	35
30 cents to 50 cents per dozen	.....	52	.....	.....	.....
40 cents to 50 cents per dozen	.....	.....	65	65	.....
50 cents to $1 per dozen	.....	55	.....	.....	.....
50 cents to $1.25 per dozen	.....	.....	95	95	.....
50 cents to $1.50 per dozen	97	.....	.....	.....	.....
$1 to $1.50 per dozen	.....	55	.....	.....	.....
$1 per dozen	.....	.....	.....	.....	55
$1.25 to $3 per dozen	.....	.....	91	90	.....
$1.50 to $3 per dozen	95	58	.....	.....	.....
$3 per dozen	85	50	84	83	.....

uly 1, 1893–Aug. 27, 1894.

As between the classes, however, these rates had a peculiar result. der the act of 1909 the classes were divided at 40 and 50 cents, and 25 and $3 per dozen. At 40 cents, the knives bore a 40 per cent valorem duty; at 41, a compound duty equivalent to 69.3 per cent; 45 to 66⅔; at 50 to 64. Within the 41–50 cent class the duty was s regressive, heavier on the cheaper grades. This is true of all the sses; knives at the beginning of the next class bore a higher duty 9 per cent if valued at 55 cents) than at the end (90 per cent if lued at $1.20). In the next class those valued at $1.30 bore a ty equivalent to 132 per cent, while the rate decreased according the value per dozen was greater—63⅓ per cent, for instance, on ives valued at $6 per dozen. Thus the highest and lowest rates adjacent to each other—knives valued at 40 cents per dozen, 40 r cent; 41 cents, 69.3 per cent; 50 cents, 64 per cent; 55 cents, 149 r cent; $1.20, 90 per cent; $1.30, 132 per cent. The result of this rangement of duties was to put pressure to bear toward the under- luation of the knives falling in the lower valuations of each class, so to bring them within the one just below, or toward an actual eapening of the product to accomplish the same result. The ties thus acted toward the suppression of imports belonging to rtain classes. The same criticism may be made of the act of 1913, hich provided for two classes, at different ad valorem rates, but in s act the difficulty is to some extent obviated by the lack of many

classes and the slighter difference in rates near the boundaries of the two classes.

The provisions for parts under the acts of 1897 and 1909 resulted in extremely high rates, on an ad valorem basis, falling on these articles—115 per cent on parts, and 100 on assembled knives, not fully finished, under the act of 1909. Imports of this kind have formed but a very small proportion of total imports under the two acts. Under the act of 1913, which levied the same duty on parts and assembled, not fully finished knives, as knives, they have increased from approximately $575 yearly under the first act to slightly less than $4,000 under the second, up to June 30, 1918. This amount forms only 0.7 per cent of the total imports.

The inclusion of erasers in the pocket-knife schedule may be justified on the ground that they are made by the manufacturers of pocket knives. Pruning, budding, and manicure knives, to which the above argument is less applicable, are dutiable as pocket knives, at a higher rate than falls upon other straight knives—butchers, artists, kitchen, drawing, etc. (sec. E).

Pen and pocket knives—Production in United States.

[From Tariff Hearings.]

1882	[1] $1,320,000	1893	[1] 1,000,000
1887	[1] 815,000	1897	[1] 1,100,000
1888	[1] 795,000	1907	[3] 3,500,000
1889	[1] 733,000		[4] 2,940,000
1892	[1] 1,500,000	1912	[4] 3,200,000

Pocket knives—Production in United States—From Federal census, calendar year 1914, $1,177,000. Product of pocket-knife establishments, $4,058,000; other cutlery and edge tool establishments, $7,000; other establishments, $21,313.

Cutlery, pen or pocket knives—Imports by countries (fiscal years).

Imported from—	1912		1913		1914	
	Number.	Value.	Number.	Value.	Dozens.	Value.
Germany	11,022,318	$629,795	11,078,482	$598,382	1,222,759	$1,000,000
United Kingdom	985,745	151,643	800,800	126,249	92,236	79,000
Austria-Hungary	290,798	27,792	326,799	21,564	37,483	6,000
France	72,454	5,529	19,380	1,311	2,130	1,000
Sweden	6,320	1,876	17,311	4,142	2,441	1,000
All other	5,949	648	15,227	886	1,077	1,000
Total	12,383,584	814,283	12,258,059	752,705	1,358,147	1,200,000

Imported from—	1915		1916		1917	
	Dozens.	Value.	Dozens.	Value.	Dozens.	Value.
Germany	966,053	$869,401	183,094	$139,605	9,961	$7,000
United Kingdom	63,581	122,836	51,246	103,982	17,794	35,000
Austria-Hungary	24,106	26,348	200	230		
France	245	383	110	130	23	2
Sweden	1,135	2,871	933	4,288	340	1,000
All other	2,890	3,631	654	832	1,580	1,000
Total	1,058,010	1,025,470	236,177	249,087	29,702	45,000

NOTE.—Included in "All other cutlery" prior to 1912.

[1] American Pocket Cutlery Manufacturers, 1894. Auxiliary File.
[2] Same, 1913. Auxiliary File.
[3] Same, 1909. Auxiliary File.
[4] Alfred Field & Co., agents for Joseph Rogers & Sons, 1920, Auxiliary File.

lery, pen or pocket knives—Imports by countries (fiscal years)—Continued.

ported from—	1918		1918 [1]		1919 [1]	
	Dozens.	Value.	Dozens.	Value.	Dozens.	Value.
					38,269	$53,230
ngdom	8,846	$38,749	7,704	$34,237	16,473	46,147
ungary						
	41	66		6	27	464
	133	560	165	1,252	3,035	16,696
	17,578	16,981	71,391	60,713	64,867	55,870
	20	45	81	188	2,506	2,759
d	26,618	56,401	79,341	96,396	125,177	175,166

ar year.
rly included in "All other." Imports for 1914, $9; 1915, $189; 1916, $266, 1917 $1,188.

ocket knives, and all knives which have folding or other than fixed blades and tachments, and parts of—Imports for consumption—Revenue—Summary.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
	Specific and ad valorem.	14,808,091	$1,007,799	$788,386	$0.068	78.22
	do	10,802,788	845,554	673,127	.078	79.60
	do	9,925,078	709,952	572,457	.072	80.63
	do	12,642,068	789,662	604,164	.062	76.51
	do	12,196,950	804,679	624,624	.066	77.62
	do	12,489,546	811,121	630,069	.065	77.68
	do	11,911,362	724,896	547,458	.061	75.52
	do		1,302,255	637,930		48.99
		Dozens.				
	Various ad valorem	1,040,994	1,010,264	465,548	.970	46.08
	do	268,896	285,878	134,654	1.06	47.10
	do	31,497	68,738	35,918	2.18	52.25
	do	26,725	56,601	29,015	2.12	51.26
	do	93,494	91,741	42,313	.98	46.12
	do	97,269	139,422	68,567	1.43	49.18
	do	319,188	585,376	300,706	1.52	51.37

ır year.

ocket knives, clasp, pruning, and budding knives, erasers, and manicure knives, 's of, wholly or partly manufactured, valued at not more than 40 cents per -Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
	40 per cent	6,310,884	$165,419	$66,168	$0.026	40
	do	3,326,075	102,509	41,004	.031	40
	do	3,737,839	89,623	35,850	.024	40

Pen or pocket knives, clasp, pruning, and budding knives, erasers and manicure and all knives by whatever name known which have folding or other than fixed or attachments, and parts of, finished, valued at not more than 40 cents per Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Number.				
1910	40 per cent	6,732,209	$151,186	$60,474	$0.022	
1911	do	5,692,054	145,193	58,077	.025	
1912	do	5,797,837	151,138	60,455	.027	
1913	do	6,253,609	152,481	60,992	.024	
1914 [1]	do	1,156,096	29,067	11,627	.025	

[1] July 1 to Oct. 3, 1913, under act of 1909.

Pen or pocket knives, clasp, pruning, and budding knives, erasers, and manicur or parts of, wholly or partly manufactured, valued at more than 40 cents and than 50 cents per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	A c ac
		Number.				
1907	1 cent per piece and 40 per cent.	3,837,143	$153,766	$99,878	$0.04	
1908	do	3,482,350	140,231	90,916	.04	
1909	do	2,761,797	110,558	71,841	.04	

Pen or pocket knives, and all knives which have folding or other than fixed bl attachments, and parts of, finished, valued at more than 40 cents and not 50 cents per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	A c ac
		Number.				
1910	1 cent per piece and 40 per cent.	2,503,996	$99,984	$65,034	$0.04	
1911	do	2,805,198	112,486	73,046	.04	
1912	do	3,241,680	128,055	83,639	.04	
1913	do	2,704,663	108,855	70,589	.04	
1914 [1]	do	418,826	16,898	10,948	.04	

[1] July 1 to Oct. 3, 1913, under act of 1909.

Pen or pocket knives, clasp, pruning, and budding knives, erasers, and manicure or parts of, wholly or partly manufactured, valued at more than 50 cents and than $1.25 per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Number.				
1907	5 cents per piece and 40 per cent.	3,075,807	$288,924	$269,360	$0.094	
1908	do	2,610,845	247,158	229,406	.095	
1909	do	2,157,710	198,595	187,324	.092	

pocket knives, and all knives which have folding or other than fixed blades and ments, and parts of, finished, valued at more than 50 cents and not exceeding per dozen—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	5 cents per piece and 40 per cent.	2,107,799	$197,747	$184,489	$0.094	93.29
.....	.....do.....	2,442,499	220,307	210,248	.09	95.43
.....	.....do.....	2,106,736	186,262	179,842	.088	96.55
.....	.....do.....	1,846,516	165,932	158,699	.09	95.64
.....	.....do.....	241,627	21,282	20,594	.088	96.77

to Oct. 3, 1913, under act of 1909.

ocket knives, clasp, pruning, and budding knives, erasers, and manicure knives, ts of, wholly or partly manufactured, valued at more than $1.25 and not more than dozen—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Numaer.				*Per cent.*
.....	10 cents per piece and 40 per cent.	1,237,452	$242,636	$220,880	$0.196	91.00
.....	75 per cent of 10 cents per piece and 40 per cent.	12	2	2	.167	75.00
.....	10 cents per piece and 40 per cent.	1,071,634	215,529	193,375	.201	89.72
.....	.....do.....	1,005,734	191,052	176,994	.19	92.64

Philippine Islands.

pocket knives, and all knives which have folding or other than fixed blades and nents, and parts of, finished, valued at more than $1.25 and not exceeding $3 per —Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	10 cents per piece and 40 per cent.	1,016,831	$209,457	$185,466	$0.206	88.55
.....	.....do.....	978,960	203,053	179,117	.207	88.21
.....	.....do.....	1,004,302	195,846	178,769	.195	91.28
.....	.....do.....	828,860	164,966	148,872	.199	90.25
.....	.....do.....	117,259	23,052	20,947	.197	90.87

to Oct. 3, 1913, under act of 1909.

ocket knives, clasp, pruning, and budding knives, erasers, and manicure knives, ts of, wholly or partly manufactured, valued at more than $3 per dozen—Imports sumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent*
.....	20 cents per piece and 40 per cent.	346,793	$157,051	$132,179	$0.453	84.16
.....	.....do.....	311,684	140,124	118,427	.449	84.51
.....	.....do.....	261,998	120,122	100,449	.458	83.62

Pen or pocket knives, and all knives which have folding or other than fixed blade attachments, and parts of, finished, valued at more than $3 per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ad co ad
		Number.				P
1910	20 cents per piece and 40 per cent.	280,630	$121,261	$108,631	$0.432	
1910 [1]	75 per cent of 20 cents per piece and 40 per cent. [2]	3	1	1	.333	
1911	20 cents per piece and 40 per cent.	271,220	123,171	103,516	.454	
1912	do	335,791	149,457	126,941	.445	
1913	do	273,193	121,408	107,202	.444	
1914 [3]	do	44,544	21,261	17,421	.478	

[1] From Philippine Islands.
[2] July 1 to Aug. 5, 1909, under act of 1897.
[3] July 1 to Oct. 3, 1913, under act of 1909.

Pen or pocket knives, and all knives which have folding or other than fixed blade attachments, and parts of, finished, valued at not more than $1 per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Dozens.				P
1914 [1]	35 per cent	928,746	$492,285	$172,300	$0.531	
1915	do	784,170	449,912	157,469	.589	
1916	do	195,771	112,893	39,513	.577	
1917	do	9,375	6,730	2,356	.718	
1918	do	16,019	10,434	3,652	.651	
1918 [2]	do	70,980	36,148	12,652	.509	
1919 [2]	do	68,170	40,629	14,220	.596	
1920 [2]	do	149,082	104,861	36,701	.703	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar years.

Pen or pocket knives, and all knives which have folding or other than fixed blades tachments, and parts of, finished, valued at more than $1 per dozen—Imports sumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Dozens.				P
1914 [1]	55 per cent	399,077	$895,329	$382,431	$1.88	
1915	do	271,945	553,776	304,577	2.04	
1916	do	72,839	172,500	94,875	2.37	
1917	do	16,270	57,055	31,390	3.51	
1918	do	9,514	42,076	23,142	4.42	
1918 [2]	do	14,661	46,041	25,323	3.14	
1919 [2]	do	28,986	98,588	54,223	3.40	
1920 [2]	do	165,342	476,970	262,333	2.88	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar year.

ocket knives, and all knives which have folding or other than fixed blades and at- nts, and parts of, assembled, but not fully finished, valued at not more than $3 en—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	10 cents per piece and 40 per cent.	600	$24	$70	$0.04	290.00
.....	.....do.....	300	43	48	.144	108.57
.....	.....do.....	1,038	137	159	.132	115.77
.....	.....do.....	2,230	197	302	.088	153.26
.....	.....do.....	922	108	135	.117	125.29

Oct. 3, 1913, under act of 1909.

ocket knives, and all knives which have folding or other than fixed blades and ents, and parts of, assembled, but not fully finished, valued at more than $3 per Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	20 cents per piece and 40 per cent.	155	$59	$55	$0.38	92.54
.....	.....do.....	421	151	145	.359	95.76
.....	.....do.....	1,232	707	529	.574	74.85
.....	.....do.....	490	181	171	.371	93.94

) Oct. 3, 1913, under act of 1909.

ocket knives, and all knives which have folding or other than fixed blades and ents, and parts of, assembled, but not fully finished, valued at not more than lozen—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
.....	35 per cent.....	190	$153	$34	$0.805	35
.....	.....do.....	108	98	34	.908	35
.....	.....do.....	4,008	1,409	493	.352	35
.....	.....do.....	6,686	4,398	1,539	.658	35
.....	.....do.....	11	8	3	.727	35

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913. [2] Calendar year.

ocket knives, and all knives which have folding or other than fixed blades and ents, and parts of, assembled, but not fully finished, valued at more than $1 en—Imports for consumption—Revenue.

ear.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
.....	55 per cent.....	15	$26	$14	$1.73	55
.....	.....do.....	174	345	190	1.98	55
.....	.....do.....	57	203	112	3.57	55
.....	.....do.....	544	2,844	1,564	5.23	55
.....	.....do.....	474	2,301	1,266	4.85	55
.....	.....do.....	6	21	12	3.50	55
.....	.....do.....	827	1,565	861	1.89	55

r year.

Pen or pocket knives, and all knives which have folding or other than fixed blades and ments, and parts of, blades, handles, or other parts of, valued at not more than $1. dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Act cen ad
		Number.				P
1911	5 cents per piece and 40 per cent.	5,744	$219	$375	$0.038	
1912	do	1,704	58	108	.034	
1913	do	118	3	7	.032	
1914[1]	do	12	1	1	.082	

[1] July 1 to Oct. 3, 1913, under act of 1909.

Pen or pocket knives, and all knives which have folding or other than fixed bla attachments, and parts of, blades, handles, or other parts of, valued at more tha and not more than $3 per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	A c ac
		Number.				
1911	10 cents per piece and 40 per cent.	774	$126	$128	$0.163	
1912	do	24	3	4	.208	
1913	do	490	112	94	.23	

Pen or pocket knives, and all knives which have folding or other than fixed blades an ments, and parts of, blades, handles, or other parts of, valued at more than $3 per Imports for consumption - Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	A c ac
		Number.				
1911	20 cents per piece and 40 per cent.	27	$19	$13	$0.701	
1912	do	13	10	7	.769	
1913	do	591	233	171	.396	

Pen or pocket knives, and all knives which have folding or other than fixed blades an ments, and parts of, blades, handles, or other parts of, valued at not more tha dozen Imports for consumption -Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	A c ac
		Dozens.				
1914[1]	35 per cent	1,353	$686	$240	$0.507	
1915	do	2,310	474	166	.205	
1916	do	1,308	1,299	455	.993	
1917	do					
1918	do	166	146	51	.88	
1918[2]	do	249	175	61	.703	
1920[2]	do	3,750	1,385	485	.361	

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] Calendar year.

***Pen** or pocket knives, and all knives which have folding or other than fixed blades and attachments, and parts of, blades, handles, or other parts of, valued at more than $1 per dozen—Imports for consumption—Revenue.*

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
1914[1]	55 per cent	859	$1,928	$1,060	$2.25	55
1915	do	2,446	5,978	3,288	2.44	55
1916	do	112	140	77	1.25	55
1917	do	479	2,012	1,123	4.26	55
1918	do	482	1,101	606	2.29	55
1918[2]	do	444	2,678	1,473	6.03	55
1919[2]	do	107	204	112	1.91	55
1920[2]	do	176	587	323	3.33	55

[1] Oct. 4, 1913 to June 30, 1914, under act of 1913.
[2] Calendar year.

***Pen** and pocket knives—Imports for consumption, and revenue, for the given years under the different acts.*

Act.	Date.	Quantity.	Value.	Duty.	Value per unit.	Computed ad valorem rate.
		Dozens.				*Per cent.*
1890	1893	911,258	$911,146.03	$829,487.54	$1.00	91.04
1890	1894	459,703	441,607.54	402,937.07	1.00	91.24
1894	1897	1,585,099	1,464,359.15	767,314.13	.92	52.40
		Number.				
1897	1899	9,888,787	606,443.75	468,768.80	.061	77.3
1897	1900	12,890,380	765,018.74	588,541.42	.059	76.9
1897	1902	10,855,909	742,075.67	593,159.91	.068	79.9
1897	1905	13,096,195	835,844.26	664,563.94	.064	79.5
1897	1907	14,808,091	1,007,799.37	788,386.03	.068	78.2

***Pen** and pocket knives—Imports for consumption, and revenue, three quarters ended June 30, 1914.*

Quarters.	Quantity.	Value.	Revenue.
	Dozens.		
Oct. 4–Dec. 31, 1913	557,149	$522,115.45	$250,933.50
Jan. 1–Mar. 31, 1914	346,587	309,469.90	141,861.31
Apr. 1–June 30, 1914	394,510	358,797.20	183,290.66
Total	1,298,236	1,190,382.55	576,085.47
Yearly rate	1,730,000	1,587,000.00	741,000.00

Pen and pocket knives—Imports for consumption, and revenue.

ACT OF 1909, AUG. 6, 1909–OCT. 3, 1913.

Class.	Quantity.		Value.		Duty collected.		Value per unit.	Co pa ad fo ra
	Number.	*Per cent.*		*Per cent.*		*Per cent.*		P c
Valued at not over 40 cents per dozen..	25,631,985	50.04	$629,065.08	19.40	$251,626.03	10.11	$0.0245	
Valued at over 40 cents, not over 50 cents per dozen.....	11,674,363	22.79	466,279.99	14.38	303,255.63	12.19	.040	
Valued at over 50 cents, not over $1.25 per dozen.....	8,745,177	17.08	791,532.37	24.41	753,871.82	30.30	.0905	
Valued at over $1.25, not over $3 per dozen.....	3,946,212	7.71	796,376.49	24.56	713,171.83	28.66	.202	
Valued at more than $3 per dozen.....	1,205,400	2.35	556,580.53	17.17	463,712.02	18.64	.462	
Assembled, not finished.....	7,388	.01	1,608.53	.05	1,612.02	.06	.218	
Parts.....	9,297	.02	787.20	.03	908.98	.04	.085	
Total.....	51,219,702	100.00	3,242,230.71	100.00	2,488,158.33	100.00	.633	

ACT OF 1913, OCT. 4, 1913–JUNE 30, 1918.

Valued at not over $1 per dozen.....	1,912,081	71.71	$1,072,254.70	41.05	$375,289.15	30.73	$0.561
Valued over $1 per dozen.....	739,645	27.71	1,520,736.85	58.23	836,405.27	68.49	2.056
Assembled, not finished.....	5,096	.19	5,078.00	.19	2,460.90	.20	.996
Parts.....	9,516	.36	13,794.00	.53	7,065.70	.58	1.450
Total.....	2,666,338	100.00	2,611,863.55	100.00	1,221,221.02	100.00	.780

Court and Treasury Decisions.

The terms "pocketknives" and "penknives" have been held to clude so-called *budding knives* made with folding blades at one and ivory or bone blades, not folding, at the other end (T. D. 60 *knives with one folding blade intended for budding or pruning* and t carried in the pocket (G. A. 1486, T. D. 12935); *knives with a sh blade* specially designed for cutting corns (G. A. 2365, T. D. 146 *horn or bone handle knives with two blades and lock spring* (G. A. 25 T. D. 14833), and fiddlers' knives, pearl handled and having in pl of blades (1) grips made in the form of scissors and used for catch the ends of violin strings; (2) scissors for cutting strings; (3) blades of the ordinary pattern claimed to be intended for smoothi the upper edge of violin bridges; and (4) a pitch pipe in one e (G. A. 4018, T. D. 18620). *Knives with letter-opener attachment* w declared something more than penknives, and were held to be with the provision for knives with "folding or other than fixed blades attachments" (Silbertstein *v.* U. S., 3 Ct. Cust. Appls., 239). So we *knives with folding blades and spring backs*, designated as budding pruning knives. The fact that some of the articles enumerated paragraph 128 of the act of 1913 may be put to agricultural uses do not make them exempt from duty under paragraph 391 as agricu tural implements (Quirk *v.* U. S., 6 Ct. Cust. Appls., 444). Chief u controls classifications under the two paragraphs (U. S. *v.* Baker, 6(

st. Appls., 243). *But mother-of-pearl cut for knife handles* and other icles was held dutiable as manufactures of mother-of-pearl rather an as parts of knives (U. S. *v.* U. S. Exp. Co., 94 Fed., 642; Morris ropean and Am. Ex. Co. *v.* U. S., 150 Fed., 608). *Small knives* have en held in some cases dutiable as toys and in other cases as knives. the leading case they were declared not properly playthings for ldren and dutiable as penknives (Kastor *v.* U. S., 167 Fed., 993). *A knife about 6 inches long, with a 5-inch folding blade*, which when ened fastened with a spring lock, was declared to be a hunting her than a clasp knife in the commercial sense, and accordingly tiable under paragraph 155 of the act of 1897. (U. S. *v.* Borgfeldt, t. Cust. Appls., 255.)

Knives of the kind enumerated in paragraph 153 of that act, and parts reof, wholly or partly manufactured, were held dutiable according value under the provisions of and not under the proviso to said agraph. (G. A. 5217, T. D. 24026; U. S. *v.* Silberstein, 105 Fed., 5, affirming 99 Fed., 263.)

Manicure files and knives for watch charms have been held not duti- e as knives (T. D. 20760, 21195, 24865, and 25361). *Knives used y for pedicure purposes or surgical operations* are not manicure ives (Abstract 25010, T. D. 31352). *Pocket knives to which handles scales of a cheap material have been attached*, resulting in fully fin- ed and salable knives, were held to be finished knives within para- ph 152 of the act of 1909, although jewelry manufacturers removed handles and substituted therefor gold or silver handles (G. A. 7, T. D. 33593).

Pocket knives with chain and ring attached were held separately duti- le when separately itemized and valued on the invoice. (G. A. 27, T. D. 18629.)

Seven-thousandths of a cent (0.007) in excess of $1 per dozen is not gligible, and knives so valued are dutiable at 55 per cent ad valorem der paragraph 128, act of 1913, and not 35 per cent, the rate on ives valued at not more than $1 per dozen. (Abstract 38162.)

Steel brush ink erasers were held dutiable as cutlery under paragraph 5 of the act of 1890 (G. A. 2728, T. D. 15235), and *metal erasers th fixed blades set in handles of wood or other material* were classified der paragraph 152 of the act of 1909 (Irwin *v.* U. S., 2 Ct. Cust. pls., 296).

Knives and erasers not marked as required by paragraph 128 of the of 1913 may be exported, or be sold as abandoned, subject to rking by the purchaser (Art. 451, Cust. Reg., 1915). Formerly ives not marked were destroyed (T. D. 16156).

"*Nippon*" with the name of the maker or purchaser constitutes legal rking of Japanese knives. (T. D. 37828.)

The value of coverings is included as a part of the dutiable value of ives. (G. A. 3325, T. D. 16806.)

"All knives by whatever name known * * * which have fold- or other than fixed blades or attachments" has been interpreted to lude camping knives with folding blades and spoon and fork at- hments (G. A. 7968, T. D. 36702, of 1916); also bistouries and lpels with folding blades (G. A. 7903, T. D. 36385, of 1916).

Pen and pocket knives—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, s and ad valor
1883	207	Penknives, pocketknives of all kinds	50 per cent ad v
1890	165	Penknives or pocketknives of all kinds, or parts thereof, and erasers, or parts thereof, wholly or partly manufactured, valued at not more than 50 cents per dozen.	12 cents per doz
		Valued at more than 50 cents per dozen and not exceeding $1.50 per dozen.	50 cents per doz
		Valued at more than $1.50 per dozen and not exceeding $3 per dozen.	$1 per dozen.
		Valued at more than $3 per dozen	$2 per dozen.
		And in addition thereto on all the above	50 per cent ad v
1894	138	Penknives, pocketknives, or erasers, of all kinds, valued at not more than 30 cents per dozen.	25 per cent ad v
		Valued at more than 30 cents per dozen and not exceeding 50 cents per dozen.	12 cents per do
		Valued at more than 50 cents per dozen and not exceeding $1 per dozen.	25 cents per do
		Valued at more than $1 per dozen and not exceeding $1.50 per dozen.	40 cents per do
		Valued at more than $1.50 per dozen and not exceeding $3 per dozen.	75 cents per do
		Valued at more than $3 per dozen	50 per cent ad
		And in addition thereto, on all the foregoing valued at more than 30 cents per dozen and not more than $3 per dozen.	25 per cent ad
		Provided, That blades, handles, or any other part of any or either of the articles named in this paragraph, imported in any other manner than assembled in penknives, pocketknives, or erasers, shall be subject to no less rate of duty than herein provided for penknives, pocketknives, or erasers, valued at more than 30 cents per dozen.	
1897	153	Penknives or pocketknives, clasp knives, pruning knives, and budding knives of all kinds, or parts thereof, and erasers or manicure knives, or parts thereof, wholly or partly manufactured, valued at not more than 40 cents per dozen.	40 per cent ad
		Valued at more than 40 cents per dozen and not exceeding 50 cents per dozen.	1 cent per piec per cent ad
		Valued at more than 50 cents per dozen and not exceeding $1.25 per dozen.	5 cents per d 40 per cent lorem.
		Valued at more than $1.25 per dozen and not exceeding $3 per dozen.	10 cents per p 40 per cent lorem.
		Valued at more than $3 per dozen	20 cents per p 40 per cent lorem.
		Provided, That blades, handles, or other parts of either or any of the foregoing articles, imported in any other manner than assembled in finished knives or erasers, shall be subject to no less rate of duty than herein provided for penknives, pocketknives, clasp knives, pruning knives, manicure knives, and erasers valued at more than 50 cents and not more than $1.50 per dozen.	
1909	152	Penknives, pocketknives, clasp knives, pruning knives, budding knives, erasers, manicure knives, and all knives by whatever name known, including such as are denominatively mentioned in this section, which have folding or other than fixed blades or attachments, valued at more than 40 cents per dozen.	40 per cent ad
		Valued at more than 40 cents per dozen and not exceeding 50 cents per dozen.	1 cent per p 40 per cen lorem.
		Valued at more than 50 cents per dozen and not exceeding $1.25 per dozen.	5 cents per p 40 per cen lorem.
		Valued at more than $1.25 per dozen, and not exceeding $3 per dozen.	10 cents per p 40 per cen lorem.
		Valued at more than $3 per dozen	20 cents per p 40 per cen lorem.
		Provided, That any of the foregoing knives or erasers, if imported in the condition of assembled, but not fully finished, shall be dutiable at not less than the rate of duty herein imposed upon fully finished knives and erasers of the same material and quality, but not less in any case than 10 cents each and 40 per cent ad valorem.	
		Provided further, That blades, handles or other parts of any of the foregoing knives or erasers shall be dutiable at not less than the rate herein imposed upon knives and erasers valued at more than 50 cents per dozen and not exceeding $1.25 per dozen:	
		Provided further, That on and after October 1, 1909 all the articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die sunk conspicuously and indelibly on the shank or tang of at least one or, if practicable, each and every blade thereof.	

Pen and pocket knives—Rates of duty—Continued.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1913	128	Penknives, pocketknives, clasp knives, pruning knives, budding knives, erasers, manicure knives, and all knives by whatever name known, including such as are denominatively mentioned in this section, which have folding or other than fixed blades or attachments, all the foregoing, whether assembled but not fully finished or finished, valued at not more than $1 per dozen.	35 per cent ad valorem.
		Valued at more than $1 per dozen	55 per cent ad valorem.
		Provided, That blades, handles, or other parts of any of the foregoing knives or erasers shall be dutiable at not less than the rate herein imposed upon knives and erasers of which they are parts:	
		Provided further, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die sunk conspicuously and indelibly on the blade, shank, or tang of at least one or, if practicable, each and every blade thereof.	

RAZORS.

SECTION B. CUTLERY UNIT.

Razors—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2]	Ratio to production.[3]		Value (imports for consumption.)[2]	Amount of duty.[2]	Value per unit of quantity.	Equivalent ad valorem rate.
				Imports.	Exports.				
		Number.		*Per cent.*	*Per cent.*				*Per cent.*
1910			(4)			$305,657	$218,042		71.34
1911		2,493,923	(4)			375,835	267,964	$0.151	71.30
1912		2,352,472	(4)			393,078	284,423	.167	72.36
1913		2,442,060	$367,964			387,779	265,940	.159	68.57
1914	$5,037,000		472,252	9.39	9.37	473,045	248,956		52.63
		Dozen.							
1915		159,628	659,103			289,390	140,601	1.81	48.58
1916		37,582	2,278,824			72,305	36,366	1.92	50.29
1917		11,746	2,089,489			27,363	14,484	2.33	52.93
1918		10,076	2,355,377			45,829	25,150	4.55	54.88
1918[5]		14,787	1,905,385			68,521	37,543	4.63	54.79
1919[5]		16,036	4,150,803			70,462	38,235	4.39	54.26
1920[5]		59,239				428,964	234,785	4.08	54.73

[1] Calendar year.
[2] Fiscal year ending June 30.
[3] Values.
[4] Figures not available.

General Information.

PARAGRAPH 128, ACT OF 1913.

* * * razors, * * * whether assembled but not fully finished or finished; valued at not more than $1 per dozen, 35 per cent ad valorem; valued at more than $1 per dozen, 55 per cent ad valorem: *Provided*, That blades, handles, or other parts of any of the foregoing * * * razors * * * shall be dutiable at not less than the rate herein imposed upon * * * razors * * * of which they are parts: * * * *Provided further*, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die-sunk conspicuously and indelibly on the blade, shank, or tang of at least one or, if practicable, each and every blade thereof.

DESCRIPTION.

There are two kinds of razors—the old-fashioned straight razor and the safety razor. The former is standardized in design, the latter differs in design among the various makes, but are sold by the different companies in standard sets at the same prices for corresponding sets.

The blade of the straight razor has a thick back, but is ground to extreme thinness for over half its breadth. The safety-razor blade is a thin plate, ground on one or both edges. The shaving edge is much shorter than that of the straight blade.

DOMESTIC PRODUCTION.

The industry is one which produced a product valued at $5,000,000 in 1914.

Materials.—The most important material used in the manufacture of razors is the steel for the blade. In the ordinary straight razor the handle is of but minor importance. It is made of bone, ivory, or a composition material. The handle or holder of the safety razor is formed of steel or brass, usually plated with nickel or silver, sometimes with gold.

The steel required for a straight razor blade is a fine quality hard steel (carbon approximately 1.25 per cent). The best grades are made from Swedish iron, converted to steel by the cementation process (heating in ovens with charcoal) and the steel further treated in the crucible. This crucible steel was formerly imported. Other steels are used. The cheapest grade of German razor is made from Bessemer steel. The steel for some of the slightly better Swedish razors is made by a modified Bessemer process.

Blades, both of straight and safety razors, have been imported to a slight extent.

Equipment. Equipment for forging, heat treatment, and grinding the blades is necessary for the manufacture of the straight razor. Drop forging and the hydraulic press are now used in the first process formerly done by hand, on the anvil. The grinding is done on power stones of very small diameter (from 1 to 4 inches)—for the final processes.

Automatic machinery is used in the manufacture of safety razors.

Methods of production.—In the early hand-forging method the blade was formed from a bar by the worker on his anvil and then tempered and hardened. This required great skill on the part of the forger, both in forging and tempering, because of the high carbon content of the steel and the thick back and thin edge. Drop forging and hydraulic presses have been used in the forging.

A rough grinding follows the forging, and the blade is then heat treated (tempered and drawn) to give it proper hardness for its purpose. This process is of great importance in relation to the quality of the blade.

The blade is now ready for grinding. It is first ground to an edge, then hollow-ground along the blade by means of a ribbed stone, finally ground again from back to edge. This last grinding is a difficult operation because of the extreme thinness of the blade and

danger of heating during the process. Finally the blade is glazed and buffed on small leather-covered wheels, a polishing material being used.[1]

The safety razor and blades are produced by automatic machinery. The processes differ with the plants, for the different makes vary in construction and are patented articles. Many of the processes are trade secrets.

Organization.—The manufacture of safety razors and blades permits large scale methods, in so far as not restricted by the limit of demand for the article. The manufacture of the straight razor is not so well fitted to such organization.

The capitalization of the industry in 1914 was $4,992,000, divided among 28 firms. Figures showing the proportion of large and small firms are not available.

Geographical distribution.—New York, Ohio, Connecticut, Pennsylvania, and Massachusetts lead in the number of firms producing razors. The presence of a labor supply and the small importance of transportation charges go to explain this concentration in the East.

Domestic production and consumption.—The domestic production of razors in 1914 was $5,037,000, imports $473,000, and exports $472,000. The imports and exports thus each form over 9½ per cent of the production, a relatively high amount. Since that date imports decreased and exports increased. A big increase in imports took place in 1920.

Prior to the war a large quantity of the straight razors consumed in the United States were imported. This was due, in the fine qualities, to the long-established reputation for superiority which Sheffield and Solingen razors possessed. This superiority has been due to the high development of technical skill in the European centers of razor production. In addition the cheapest grades are imported and are not made in the United States. The development of the production of the finest grades of steel here, since the shutting out of imports caused by the war, renders the permanence of the foreign superiority in the finest grades doubtful.

The production of safety razors in the United States is doubtless in excess of consumption. The reverse seems true of straight razors, although a certain quantity is exported.

Exports.—Exports have been made up of both straight and safety razors. In the fiscal years 1913–14 an average of $420,000 per year was exported. In 1915 exports were slightly less than $660,000; in 1916, $2,280,000; and in 1919 (calendar year), $4,150,803.

In the two fiscal years preceding the war approximately 65 per cent of the exports went to the United Kingdom, Argentina, and Canada; the remaining export was scattered. In 1916 and 1917, in addition to a largely increased export to Great Britain and France, there was also greater export to other markets, South America and Australia, for instance.

On these export markets the American razors met competition principally from German and English razors. Both of these countries send safety razors as well as straight razors to the export markets.

[1] G. I. H. Lloyd, The Cutlery Trades, 1913, p. 50, and elsewhere.

FOREIGN PRODUCTION.

The chief foreign producers are Germany and the United Kingdom. Sweden and France are likewise important, each with a considerable export trade.

The straight razor is an article in which high quality is demanded. Great Britain and Germany have the advantage of long-established industry, reputation, and great technical skill in the production of fine quality razors. Germany also manufactures very cheap razors not made to any extent here.

Safety razors are likewise manufactured in these countries in imitation of the American product. The German make is a cheap article.

IMPORTS.

Quantity.—For the five fiscal years unaffected by the war, imports were somewhat over 2,000,000 razors per year, valued at an average of $387,000. The three following years, 1915–1917, show smaller imports; in the last year they were only 11,700 dozen, valued at $27,000; 10,000 dozen came in in 1918, valued at $46,000. In 1920 (calendar year) imports amounted 89,239 dozen valued at $428,964.

Varieties.—Under the act of 1909 razors were classified according to value. Fifty-three per cent of the quantity imported were valued at less than $1 per dozen, but these formed only 27 per cent of the value of the razors imported and furnished only 13 per cent of the revenue. The next two classes, covering razors valued at $1 and less than $2 per dozen formed but 10 per cent of the quantity, 9 per cent of the value, and furnished 11¼ per cent of the revenue. The next two classes $2 or above per dozen were the most important as to value, forming 36 per cent of the quantity, 64 of the value, and furnishing 75 per cent of the revenue. Blades and parts, excluding safety blades, formed less than one-half of 1 per cent of the imports.

Source.—Germany sent the greater portion of these imports. During the three fiscal years 1912 to 1914 they averaged $376,000 yearly and formed 90.5 per cent of the total imports. The United Kingdom sent $33,000 yearly, 8 per cent of the total. Sweden contributed somewhat less than 1 per cent. France about one-fourth of 1 per cent. In the three following years, Germany sent $109,000 yearly, 83.8 per cent of the import; the United Kingdom $16,000, or 12 per cent; Sweden, 1.4 per cent; and France one-half of 1 per cent.

The act of 1913 provides for razors valued at not more than $1 per dozen, and those at $1 or more. Up to June 30, 1918, the first class again forms about one-half of the quantity of the imports and one-fourth of the value. Blades (including safety) and parts form a larger share of the import, 5 per cent under this act to June 30, 1918. The import is thus clearly of two kinds—the very cheapest grades and the better grades.

Safety and straight razors are not separated. There is a small import of safety razor blades.

Nature.—Imports, prior to the war, were continuous; and at least to the extent to which they were composed of razors valued at less *than* $1 per dozen, they were supplementary to domestic production. This is to some extent true of the best grade of razors, sold on a reputation for superior quality.

Revenue.—Under the act of 1909 (Aug. 6, 1909–Oct. 3, 1913) the revenue averaged approximately $252,000 per year, collected at specific rates equivalent to 71 per cent ad valorem. On the cheapest grade, the duty was at 35 per cent ad valorem; on the next two grades, equivalent to 88 and 89 per cent ad valorem, respectively; the next two (most important from the point of view of value, and furnishing 74 per cent of the revenue), the rates were equivalent to 89 and 78 per cent, respectively. These rates were a decided increase over those of the preceding act, which were equivalent to 55 and 61 per cent.

The act of 1913, establishing rates of 55 and 35 per cent, was followed by a decrease in revenue, arising from the decreased imports after the outbreak of the war. Imports for the first three quarters under the act of 1913, which were not affected by the war, were at a yearly rate of $523,000, yielding a revenue of $257,000, slightly greater than the average yearly revenue under the preceding act, $252,000, and this at rates averaging 49 per cent, as against 71 per cent under the act of 1909.

TARIFF HISTORY.

The acts of 1883 and 1894 provided ad valorem duties on razors—the latter act at 45 per cent. The act of 1897 adopted compound duties (which were imposed by that of 1890) laid according to the value of the razor: upon those valued at less than $1.50 per dozen, 50 cents per dozen and 15 per cent ad valorem; on those valued at $1.50 and below $3, $1 per dozen and 15 per cent ad valorem; on those valued at $3 per dozen or more, $1.75 per dozen and 20 per cent ad valorem. The act of 1909 made a more minute division. Razors valued at less than $1 bore a duty of 35 per cent; valued at $1 and less than $1.50, a duty of 6 cents each and 35 per cent ad valorem; valued at $1.50 and less than $2, 10 cents each and 35 per cent ad valorem; at $2 and less than $3, 12 cents each and 35 per cent ad valorem; at $3 or more, 15 cents each and 35 per cent ad valorem. Blades were to pay duty not less than that imposed on razors valued at $2 per dozen, with the exception of safety-razor blades. The act of 1913 provided only two classes—those valued at not more than $1 per dozen, and those of greater value, and laid a duty of 35 per cent on the first classification, 55 on the second. Blades and parts were made dutiable at a rate not less than the razors of which they were parts.

The ad valorem duties and ad valorem equivalents of the compound duties laid are presented in the following table:

Value per dozen.	Acts of—				
	1890	1894	1897	1909	1913
	Per cent.	*Per cent, advalorem.*	*Per cent.*	*Per cent.*	*Per cent, advalorem.*
than $1		45		35	35
than $1.50		45	56		
than $4	66	45			
ss than $1.50		45		87.9	
, less than $2		45		98.31	
, less than $3		45	54		
ss than $3		45		88.86	
d over		45			55
d over		45	58	78.20	
d over	63	45			

The act of 1909 thus marks a very decided increase in rate over the preceding, except for razors valued at less than $1 per dozen. The duty falling on blades (not safety) and parts amounted to 116 per cent ad valorem.

The imports of razors increased steadily under the act of 1897, to 1907 reaching a value ($534,000) over twice as great as in 1899. They fell off from that date, and under the act of 1909 averaged only $354,000 per year. The import of blades, handles, and parts fell to practically nothing. The lower rates of the act of 1913 were followed by a decrease in import caused by war conditions. In the first three quarters in which the act was in force—those just prior to the war—importations were at a yearly rate of $523,000. Imports of blades and handles, at less than one-half the previous rate, increased markedly. Thus imports varied, prior to the war, inversely with the rate of duty.

COMPETITIVE CONDITIONS.

Safety razors.—The process of the manufacture of the safety razor avoids the difficulty which the American manufacturer has met in making the straight razor. It practically eliminates hand forging and grinding, substituting automatic machinery for hand manipulations, and is capable of quantity production.

The safety razor is an American invention. On the domestic market competitors with the original company have sprung up. The Germans have imitated the American product, and some safety razors are made likewise in Great Britain. The American razor has the advantage of being the first in the field; competition has come in the cheaper grades, rather than those of the highest quality.

The American safety razor is exported to all parts of the world. It is subjected to competition from the German articles, usually very much cheaper.

On the domestic market there has been some sale of German blades.

Straight razors.—In straight razors the American manufacturer stands in a very different position. He does not manufacture the cheapest grades, which form half the number of the razors imported. In the best grades the foreign product has a long-established reputation for superiority, arising from the technical proficiency in manufacture attained by European industry. This reputation is a very powerful one in the case of razors, where the quality is usually a consideration far outweighing the price. A large part of the American market was, prior to the war, in European hands.

Since the outbreak of the war one large domestic company, which formerly bought its razors from Germany, finding them better and at a slightly less price with the duty added, has bought them in this country. It states that the domestic razors are satisfactory, at a slightly higher price than that paid for the foreign article, and is under the impression that it will be able to continue buying in the United States. In 1916 orders for American straight razors were placed in Australia.[1]

The Argentine market.—Argentina has been the second most important market for exported razors.[2] The Argentine statistics of

[1] Consular Reports, Miscellaneous Series, No. 42, p. 80.

[2] The United Kingdom takes a larger amount. Canada exceeded Argentina in 1916; France in 1917.

orts at the outbreak of the European war show the condition of market at that time.[1] Argentina imported, during the two s 1913 and 1914, approximately $300,000 worth of razors. nany furnished 74 per cent of this amount, the United States er cent, and France and the United Kingdom together, 3½ per . Safety razors formed 15 per cent of the imports. Of the ty razors, Germany sent 71 per cent, the United States 20; of others, Germany 75, the United States 19. Thus these two ıtries divide the market for other razors in approximately the ə proportion as that for safety razors.

TARIFF CONSIDERATIONS.

ıe duties provided for razors by the act of 1913—35 and 55 per —are the same as those laid on pocket knives (sec. A, p. 4). In two previous acts the duties were compound. Under that of 1897 ate falling on razors valued at $1.40 per dozen (50 cents per dozen 15 per cent) was equivalent to 51 per cent ad valorem, while that ng on those valued at $1.50 per dozen was equivalent to 82 per . The ad valorem equivalent declined as the value rose, reaching er cent on razors valued at $2.95 per dozen. On those valued at t was 78½ per cent, and less as the value increased above that t—at $6, for instance, it was 49.2 per cent. The act of 1909, h had more minute subdivisions, shows the same inequalities: 5 cents a dozen, razors were dutiable at 35 per cent; at $1 the valent ad valorem rate was 107 per cent; at $1.45, 84 per cent; at 0, 115 per cent; at $1.90, 98 per cent; at $2, 107 per cent; at 0, 85 per cent; at $3, 95 per cent, and above that decreasing—65 cent at $6, for instance.

his schedule put pressure on the importer to enter his goods under of the classes bearing the less ad valorem rate. Since high rates on the lowest valued razors of each class, and low upon the highest ed of the class below, and there were often wide differences in e rates, as shown above, the importer would desire to have his ls, if they fell near a class division, entered in the lower rather ı the higher classification.

he tariff of 1913 mitigates this evil of classification by the estab- nent of only two classes. The difference in duty exerts the same sure when the valuation of the razor falls near the line, though this rence is not quite so great as that occurring between the classes ıe act of 1897, and much less than that between the lowest classes ıat of 1909.

he schedules of these acts have been fitted to straight razors and r blades. A separate specification of safety razor blades and ty razors seems desirable, if a specific rate is to be imposed on rs, because of the great difference between them and straight rs.

Razors, plain and safety—Production in United States (calendar year).

a Federal Census: In year 1914, the production was valued at $5,037,000. Product of razor establish- $4,912,000; in other cutlery and edge-tool establishments, $18,030; in other establishments, $107,315.

Straight razors—Production in United States.

[From Tariff Hearings.]

	Quantity.[1]	Value
	Number.	
1907		[illegible]
1908		[illegible]
1912	[3] 1,000,000	[illegible]

[1] Estimate, E. B. Vreeland; p. 4, auxiliary file.
[2] Estimate, three manufacturers; p. 3, auxiliary file.
[3] Estimate, H. L. Henry; p. 3, auxiliary file.

Razors, and parts of—Imports by countries (fiscal years).

Imported from—	1912	1913	1914	1915	1916	1917
Germany	$361,729	$354,406	$411,866	$273,319	$49,519	[illegible]
United Kingdom	29,971	29,826	40,094	20,338	13,179	[illegible]
Sweden	2,613	5,172	3,005	2,242	1,900	[illegible]
France	1,193	997	779	621	293	[illegible]
Belgium	319	116	50	482	.....	.....
All other	1,096	786	1,666	2,209	321	[illegible]
Total	396,921	391,303	457,460	299,211	65,212	[illegible]

NOTE.—Included in "All other cutlery" prior to 1912.

Imported from—	1918	1918[1]	1919[1]	
			Dozen.	
Germany			7,545	[illegible]
United Kingdom	$14,971	$9,326	2,006	[illegible]
Sweden	7,391	17,343	3,844	[illegible]
France	1,005	938	74	
Canada[1]	25,291	44,163	.....	.....
All other	2,846	2,253	1,224	
Total	51,504	74,023	14,693	[illegible]

[1] Formerly included in "All other." Imports in 1915, $358; 1916, $8; 1917, $48.

Razors—Imports for consumption—Revenue—Summary.

Fiscal year	Rate of duty.	Quantity	Value.	Duty collected.	Value per unit of quantity.	Ad valorem rate
		Dozen.				*Per cent.*
1907	Various	255,129	$533,904	$206,663	$2.09	
1908	do	218,076	462,884	263,935	2.12	
1909	do	196,940	341,421	241,109	2.24	
1910	do	135,657	218,042	.....	.....	
		Number.				
1911	do	2,493,923	575,835	267,964	.151	
1912	do	2,352,172	363,078	284,423	.107	
1913	do	2,112,060	287,779	265,940	.159	
1914	do	1,647,945	248,956	.....	.....	
		Dozen.				
1915	Ad valorem	159,628	289,390	140,691	1.81	
1916	do	37,782	72,305	36,366	1.92	
1917	do	11,746	27,493	14,484	2.35	
1918	do	10,076	45,829	25,150	4.55	
1918[1]	do	14,787	68,521	37,543	4.63	
1919[1]	do	16,026	79,502	38,235	4.96	
1920[1]	do	89,239	428,964	234,785	4.08	

[1] Calendar years.

Razors and blades, finished or unfinished—Imports for consumption—Revenue.

VALUED AT LESS THAN $1.50 PER DOZEN.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozen.				*Per cent.*
1908	50 cents per dozen, plus 15 per cent.	87,167	$105,694	$59,437	$1.21	56.24
1909	....do	82,989	103,765	57,069	1.25	54.99
1910	....do	16,387	20,899	11,328	1.28	54.20

VALUED AT $1.50 AND LESS THAN $3 PER DOZEN.

		Dozen.				*Per cent.*
1908	$1 per dozen, plus 15 per cent.	112,574	$269,507	$153,100	$2.39	56.80
1909	....do	94,199	244,963	130,943	2.60	53.45
1910	....do	13,792	35,664	19,141	2.59	53.67

VALUED AT $3 PER DOZEN OR MORE.

		Dozens.				*Per cent.*
1908	$1.75 per dozen plus 20 per cent.	19,234	$88,682	$51,396	$4.61	57.96
1909	....do	19,752	92,692	53,105	4.69	57.29
1910	....do	2,671	12,080	7,097	4.14	58.75

Razors, and parts of, finished—Imports for consumption—Revenue.

VALUED AT LESS THAN $1 PER DOZEN.

Fiscal year.	Rates of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910	35 per cent	761,910	$53,258	$18,640	$0.070	35.00
1911	....do	1,311,948	101,419	36,557	.080	35.00
1912	....do	1,180,425	92,933	32,526	.079	35.00
1913	....do	1,424,700	112,784	39,474	.079	35.00
1914	....do	391,786	29,741	10,409	.076	35.00

VALUED AT $1 AND LESS THAN $1.50 PER DOZEN.

1910	6 cents each plus 35 per cent.	199,780	$21,888	$19,647	$0.110	89.76
1911	....do	159,707	19,038	16,266	.120	85.17
1912	....do	145,079	16,299	14,409	.112	88.41
1913	....do	86,793	9,742	8,617	.112	88.45
1914	....do	9,050	1,061	915	.118	86.03

VALUED AT $1.50 AND LESS THAN $2 PER DOZEN.

1910	10 cents each plus 35 per cent.	64,205	$10,101	$9,955	$0.157	98.56
1911	....do	119,040	18,621	18,421	.156	98.92
1912	....do	100,821	15,930	15,657	.158	98.29
1913	....do	100,583	16,082	15,687	.160	97.56
1914	....do	10,060	1,610	1,569	.160	97.47

VALUED AT $2 AND LESS THAN $3 PER DOZEN.

1910	12 cents each plus 35 per cent.	504,588	$109,050	$98,718	$0.216	90.52
1911	....do	663,086	149,116	131,866	.225	88.43
1912	....do	357,074	80,741	71,125	.226	88.04
1913	....do	315,316	70,492	62,513	.223	88.68
1914	....do	68,122	15,362	13,551	.226	88.23

Razors, and parts of, finished—Imports for consumption—Revenue—Continued

VALUED AT $3 PER DOZEN OR MORE.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound rate
		Dozen.				*Per cent.*
1910	15 cents each plus 35 per cent.	114,737	$42,166	$31,964	$0.368	
1910[1]	15 cents each plus 35 per cent less 20 per cent.	12	4	2	.333	
1911	15 cents each plus 35 per cent.	216,088	79,808	60,346	.369	
1912	do	562,877	185,951	149,514	.330	
1913	do	511,683	178,126	139,096	.348	
1914	do	88,804	32,693	24,763	.368	

VALUED AT NOT MORE THAN $1 PER DOZEN.

		Dozens.			
1914	35 per cent	102,245	$89,843	$31,445	$0.879
1915	do	98,282	92,134	32,246	.937
1916	do	17,880	16,996	5,948	.950
1917	do	1,385	1,363	477	.984
1918	do	301	274	95	.901
1918[2]	do	21	19	7	.792
1919[2]	do	951	634	222	.665
1920[2]	do	5,780	4,457	1,560	.771

VALUED AT MORE THAN $1 PER DOZEN.

1914	55 per cent	128,104	$217,912	$163,851	$2.33
1915	do	58,662	142,654	106,515	3.39
1915[1]	55 per cent less 20 per cent.	9	25	11	2.77
1916	55 per cent	19,184	54,885	30,186	2.82
1917	do	4,158	18,408	10,173	4.15
1918	do	5,126	22,175	12,186	4.33
1918[2]	do	5,240	24,066	13,236	4.55
1919[2]	do	8,358	46,880	25,780	5.61
1920[2]	do	67,541	375,675	206,621	5.56

[1] Reciprocity with Cuba. [2] Calendar years.

Blades (except for safety razors), handles, and unfinished razors—Imports for consumption—Revenue.

VALUED AT LESS THAN $3 PER DOZEN.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual compound ad val. rate
		Dozen.				*Per cent.*
1910	12 cents each plus 35 per cent.	11,246	$7,756	$1,556	$0.690	
1911	do	21,866	7,765	3,016	.355	
1912	do	5,029	836	836	.166	
1913	do	2,865	706	525	.177	
1914	do	15	4	2	.240	

VALUED AT $3 PER DOZEN OR MORE.

1911	15 cents each plus 35 per cent.	2,196	$7,5	$589	$3.34
1912	do	1,167	336	242	.288
1913	do	87	35	25	.408
1914	do	25	8	6	.308

handles, and unfinished razors, valued at more than $1 per dozen—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
.....	35 per cent.....	6,693	$1,017	$355	$0.152	35
.....	.....do.....	1,499	672	235	.448	35
.....	.....do.....	24	15	5	.625	35
.....	.....do.....	1,511	1,464	512	.969	35
.....	.....do.....	8	7	2	.875	35
.....	.....do.....	980	697	244	.711	35
.....	.....do.....	2,244	1,960	686	.873	35
.....	.....do	5,751	1,266	443	.220	35
	VALUED AT MORE THAN $1 PER DOZEN.					
.....	55 per cent.....	1,437	$3,791	$2,085	$2.64	55
.....	.....do.....	1,177	2,895	1,592	2.46	55
.....	.....do.....	187	409	224	2.19	55
.....	.....do.....	4,692	6,038	3,320	1.29	55
.....	.....do.....	4,638	23,373	12,855	5.04	55
.....	.....do.....	8,489	43,739	24,056	5.15	55
.....	.....do.....	4,480	20,979	11,538	4.68	55
.....	....do	10,192	47,566	26,161	4.67	55

lar years.

Razors—Domestic exports.

FISCAL YEARS.

xported to—	1913	1914	1915	1916	1917	1918
ingdom.....	$116,367	$196,758	$239,402	$883,769	$442,708	$468,313
.....	66,981	80,670	59,818	82,211	184,214	66,075
.....	46,962	39,099	45,675	159,826	95,526	144,519
.....	16,191	20,809	25,965	48,622	84,438	100,784
.....	17,859	20,160	16,021	24,841	45,637	95,890
.....	11,986	17,328	7,436	722,425	550,322	789,277
.....	12,740	2,832	10,306	18,236	41,361	39,023
.....	78,878	94,506	254,480	338,894	645,263	651,496
al.....	367,964	472,252	659,103	2,278,824	2,089,469	2,355,377

Included in "All other cutlery" prior to 1913.

CALENDAR YEARS.

Exported to—	1918	1919
.....	$3,814	$395,654
.....	480,587	785,424
.....	468	100,589
.....	75,287	84,094
.....	54,515	162,361
ngdom.....	417,887	876,101
.....	219,541	112,550
.....	84,515	121,891
.....	79,912	221,131
.....	98,207	146,520
dia.....	108,584	237,809
.....	282,068	906,679
al.....	1,905,385	4,150,803

Razors—Imports for consumption and revenue for selected years under various act

Act.	Date.	Quantity.	Value.	Duties.	Value per unit of quantity.	Actu comp ad va rat
		Dozen.				*Per*
1890	1893	89,242	$268,148.22	$177,450.95	$3.01	
1890	1894	51,271	154,723.47	102,835.26	3.01	
1894	1897	132,455	328,383.19	147,772.44	2.47	
1897	1899	105,805	244,644.39	140,178.95	2.31	
1897	1900	158,778	341,328.55	191,637.40	2.15	
1897	1902	175,547	387,555.25	214,322.43	2.21	
1897	1905	225,914	472,400.70	257,639.76	2.09	
1897	1907	255,429	533,903.88	296,663.20	2.09	

Razors—Imports for consumption and revenue, three quarters ended June 30, 191

Quarters.	Quantity.	Value.	Du
	Dozen.		
Oct. 4–Dec. 31, 1913	98,852	$155,472.83	$80.
Jan. 1–Mar. 31, 1914	68,286	117,882.05	59.
Apr. 1–June 30, 1914	71,361	119,208.30	57.
Three quarters	238,490	392,563.18	197,
Yearly rate	317,900	523,000.00	257.

Razors and parts—Imports for consumption and revenue.

ACT OF 1909—AUG. 6, 1909–OCT. 13, 1913.

	Quantity.	Per cent.	Value.	Per cent.	Duties collected.	Per cent.	Value per unit.
	Number.						
Valued at less than $1 per dozen	5,070,770	53.50	$393,165.00	26.67	$137,607.75	13.10	$0.0775
Valued at $1 and less than $1.50 per dozen	600,109	6.31	68,091.92	4.62	59,856.72	5.70	117
Valued at $1.50 and less than $2 per dozen	394,709	4.17	62,247.37	4.23	61,291.78	5.84	.178
Valued at $2 and less than $3 per dozen	1,908,210	20.06	425,112.25	28.84	377,771.23	35.98	223
Valued at $3 per dozen or more	1,494,171	15.71	518,751.36	35.19	405,088.15	38.64	347
Blades, handles, etc	44,539	.47	6,721.75	.45	7,801.15	.74	.151
Total	9,512,811	100.00	1,474,187.69	100.00	1,050,020.78	100.00	.135

ACT OF 1913—OCT. 4, 1913–JUNE 30, 1918.

	Dozen.						
Value at not more than $1 per dozen	220,107	48.11	$309,640.63	24.24	$70,213.50	16.95	$0.911
Valued at $1 or more per dozen	215,539	47.11	587,159.18	70.03	322,934.81	77.94	2.724
Blades, handles, etc	21,866	4.78	39,681.00	4.80	21,189.55	5.11	1.81
Total	457,512	100.00	827,450.18	100.00	414,337.86	100.00	1.81

Imports of razors into Argentina, 1913–14.

Countries.	Safety.		Others.		Total.				Grand total.	
	1913	1914	1913	1914	Safety.	Per cent.	Others.	Per cent.	Value.	Per cent.
many	$20,261	$11,109	$125,710	$86,899	$31,370	70.6	$192,600	75.0	$223,970	74.4
ed States	5,476	3,410	46,148	2,495	8,886	19.9	48,643	19.0	57,529	19.1
ce	1,140	1,297	2,975	803	2,437	5.5	3,878	1.5	6,315	2.1
ed Kingdom	1,085	179	1,997	1,123	1,264	2.8	3,120	1.2	4,364	1.4
er countries	157	405	3,885	4,986	562	1.2	8,371	3.3	8,933	3.0
Total	28,099	16,400	180,715	75,897	44,479	100.0	256,612	100.0	301,111	100.0
cent of total					14.8		85.2		10.0	

COURT AND TREASURY DECISIONS.

Corn razors were held dutiable as razors and not as manufactures metal under the act of 1890 nor under the act of 1909 as knives . A. 2686, T. D. 15160; Abstract 33104, T. D. 33644). And galli- handles for corn razors were held to be razor handles within para- ph 152 of the act of 1909 (Abstract 22824, T. D. 30410).

Small steel handles for a corn or callous remover, called "anticor" re held dutiable as manufactures of metal under paragraph 199 of t act (Abstract 29888, T. D. 32842). So were *small steel razor des* (Abstract 24124, T. D. 21029). Under the act of 1883 razor des were classified as cutlery (T. D. 17694).

Pieces of ivory cut and shaped and intended, after assembling in irs, fitted with a metal or other tine, and riveted together, to be used handles for razors, were held not dutiable as razor handles in this dition as imported, but in the absence of a provision, parts of ors, dutiable as manufactures of ivory under the act of 1909. . A. 7392, T. D. 32822).

All the parts of razors need not be imported together to fall within ragraph 128 of the act of 1913; hence razor blades designed to be- me parts of razors valued at more than $1 per dozen were held tiable at 55 per cent ad valorem under that paragraph (United ates *v.* Witte Cutlery Co., 7 Ct. Cust. Appls., 181). Not the per zen value of the separate parts but the per dozen value of the ors into which the parts will ultimately be incorporated deter- nes the rate of duty prescribed by paragraph 128 (G. A. 8111, . D. 37430). Razor handles were held properly classified under ragraph 128 at 55 per cent ad valorem (Abstract 41869, of 1918).

Pinion blanks cast in shape similar to a wire nail (1¾ inches long), th a round head about one-fourth inch in diameter at one end and t squarely off at the other end, used in making safety razors, were ld not unfinished parts of razors, but metal manufactures. (New ork practice, Nov. 27, 1918.)

Under these decisions it is at times impossible to determine defi- tely the rate of duty because the value of the razors into which the rts will be incorporated is unknown. This might be remedied by serting the words "and blades, handles, or other parts" before the rds "all the foregoing" and omitting the proviso, or by substitut- g a fixed value per dozen for the words "of which they are parts" the proviso.

Razors—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, sp and ad valorem
1883	207	* * * razors	50 per cent ad val
1890	165	* * * razors and razor blades, finished or unfinished, valued at less than $4 per dozen.	$1 per dozen.
		Valued at $4 or more per dozen	$1.75 per dozen.
		And in addition thereto on all the above razors and razor blades.	30 per cent ad val
1894	140	* * * razors and razor blades, wholly or partly finished	45 per cent ad val
1897	153	Razors and razor blades, finished or unfinished, valued at less than $1.50 per dozen.	50 cents per d plus 15 per ce valorem.
		Valued at $1.50 per dozen and less than $3 per dozen	$1 per dozen, p per cent ad val
		Valued at $3 per dozen or more	$1.75 per dozen, 20 per cent a orem.
1909	152	* * * razors, finished, valued at less than $1 per dozen	35 per cent ad val
		Valued at $1 and less than $1.50 per dozen	6 cents each, p per cent ad val
		Valued at $1.50 and less than $2 per dozen	10 cents each, p per cent ad val
		Valued at $2 and less than $3 per dozen	12 cents each, p per cent ad val
		Valued at $3 or more per dozen	15 cents each, p per cent ad val
		Provided, That blades (except for safety razors), handles, and unfinished razors shall pay no less duty than that imposed on finished razors valued at $2 per dozen:	
		Provided further, That on and after October 1, 1909, all the articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die-sunk conspicuously and indelibly on the shank or tang of at least one or, if practicable, each and every blade thereof.	
1913	128	* * * razors * * * whether assembled but not fully finished or finished, valued at not more than $1 per dozen.	35 per cent ad val
		Valued at more than $1 per dozen	55 per cent ad val
		Provided, That blades, handles, or other parts * * * of razors * * * shall be dutiable at not less than the rate herein, imposed upon * * * razors * * * of which they are parts * * *:	
		Provided further, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die-sunk conspicuously and indelibly on the blade, shank, or tang of at least one or, if practicable, each and every blade thereof.	

SCISSORS AND SHEARS.

SECTION C. CUTLERY UNIT.

Scissors and shears—Summary table.

Year.	Domestic production.[1]	Imports for consumption.[2]	Ratio of imports to production.[3]	Value (imports for consumption).[2]	Amount of duty.[2]	Value per unit of quantity.	Eq im va pe
		Dozens.	*Per cent.*				*Pa*
1910		382,980		$509,579	$265,494	$1.33	
1911		405,573		513,984	270,075	1.27	
1912		441,850		570,591	306,830	1.29	
1913		475,604		594,790	317,237	1.25	
1914	[4] $2,509,000	591,752	30.9	775,266	259,222	1.31	
1915		419,706		519,943	155,983	1.23	
1916		155,359		190,747	59,924	1.28	
1917		44,160		91,809	27,543	2.08	
1918		33,607		96,607	28,980	2.87	
1918[1]		25,350		91,317	27,395	3.60	
1919[1]		71,330		168,340	50,502	2.36	
1920[1]		211,969		518,153	155,446	2.44	

[1] Calendar year. [2] Fiscal years ending June 30. [3] Values. [4] Clippers included.

General Information.

PARAGRAPH 128, ACT OF 1913.

"Scissors and shears, and blades for the same, finished or unfinished, 30 per cent ad valorem: *Provided further*, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die sunk conspicuously and indelibly on the blade, shank, or tang of at least one or, if practicable, each and every blade thereof."

DESCRIPTION.

The distinction between scissors and shears used in the trade lies in their size; those over 6 inches long are shears. Competitive conditions differ for the two products. Snips for cutting sheet metal, which have short blades and long handles, enter the United States under the provision for shears.

DOMESTIC PRODUCTION.

The fact that scissors and shears are necessary in the clothing trade makes the industry important. Its product in 1914 was valued at $2,500,000.

Materials.—Steel and malleable iron are used in the production of scissors and shears. The kind of steel used depends upon the quality desired: Bessemer, open-hearth, or crucible. For the finest qualities "shear" steel is used, obtained by converting iron to steel by the cementation process (heating with charcoal) and welding and forging together the "blister" bars so produced. The material so obtained is uniform, tough, and ductile.

The steel used contains about 0.75 per cent carbon.

American shear manufacturers use to some extent malleable iron for the handles and backs of the blades.

Equipment.—Forging and grinding equipment is necessary for the manufacture of scissors and shears.

Methods of production.[1]—The traditional method was hand forging and grinding. The former is of great difficulty because of the formation of the relative thinness of the bows, the latter because of the complexity of the shape required.

Some scissors—of a very cheap grade—are cast from common steel. Die forging under a heavy mechanical stamp is the usual method in making the solid steel blanks.

After the blanks are formed by forging they are sent to the grinder, who roughly shapes the blade. The surface formed is a complex one; hollow ground from back to edge; concave from rivet to point; and each blade slightly twisted toward the other. After this grinding the blanks undergo heat treatment—tempering and drawing—to produce the quality of steel demanded. The blades are then finish ground; the bows and shanks ground, glazed, and polished.

In the United States a portion of the shears are made with malleable iron to form the bows and the back of the blades, and a steel strip welded on to form the cutting edge.

[1] G. I. H. Lloyd. The Cutlery Trades, 1913, pp. 42, 56-57, and elsewhere.

Organization.—Several of the manufacturers of shears and scissors have large establishments. In 1914 there were 29 establishments manufacturing scissors, shears, and clippers (for last, see under section E), with a capitalization of $2,663,000.

Geographical distribution.—Of the 38 manufacturers, 9 are located in Connecticut, 7 in New Jersey, 6 in New York, 5 in Ohio, 4 in Illinois, and the remainder in other States. An early start and the presence of skilled workmen is explanatory of the location of establishments in these States.

History of the industry.—The manufacture of shears began at Elizabethport, N. J., in 1825. In 1826 Seth Borden invented a process of welding a high grade steel blade to a soft iron backing. This was a hand operation until the early 60's, when the drop hammer was used.

Domestic production and consumption.—Shears and scissors are not specified in the export statistics. A large number of the former are exported, and American manufacturers supply the home market. Scissors, on the other hand, have been produced to only a slight extent in the United States, and the market is supplied by importation. The production of scissors has been limited by the high cost due to the extent to which hand labor must be used, and failure to develop automatic machinery to perform the processes.

In 1914 the value of the imported shears and scissors was 31 per cent of the product manufactured, including clippers.

Domestic exports.—Exports are not specified in Commerce and Navigation. American shears are sent to all countries of the world.

FOREIGN PRODUCTION.

Prior to the recent war, Germany was the chief foreign producing country. The other cutlery producing countries—the United Kingdom, France, and Sweden—are also important producers. Japanese production has increased since the outbreak of the war until in 1917 the value of its exports to the United States was exceeded only by the United Kingdom, but both were relatively small.

Germany's position has rested on the use of die forging under drop hammers in the making of scissor blanks. German scissors have successfully met competition from other scissors on neutral markets.

The figures of import into the United States indicate the classes of goods in which the foreign producers compete. The United Kingdom and France send scissors and shears the average value of which is from four to five times as much per dozen as that of the German. The Japanese import is also of cheap articles, with an average value of some 50 per cent more per dozen than the German.

IMPORTS.

Quantity.—In 1910, 382,980 dozen scissors and shears were imported, valued at $509,570.86. Each successive year showed a higher import, which reached 591,752 dozen, valued at $775,266.34 in 1914. Since the outbreak of the war, less have been imported; in 1918 only 33,607 dozen entered, valued at $96,607. In 1920 (calendar year) imports had risen to 211,969 dozen valued at $518,153.

arieties.—The classification of the act of 1909 did not differ from preceding. From August 6, 1909, to October 3, 1913, 28 per t of the quantity imported was valued at not more than 50 cents dozen. This class formed only 9 per cent of the value. The t class—valued at over 50 cents, not over $1.75 per dozen, formed per cent of the quantity, 53 per cent of the value; those valued over $1.75 per dozen, 14 and 38 per cent, respectively, of quantity d value. The act of 1913 draws no such classification.

Import consists to a geat extent of solid steel scissors.

Source.—In the last three fiscal years unaffected by the war, rmany sent 96½ per cent of the amount imported, 88 per cent of value. The United Kingdom sent 3 and 10½ per cent of quantity d value, respectively. Japan sent less than one-tenth of 1 per t.

During the next three years, 1915–1917, with a greatly decreased port, Germany sent 90 per cent of the quantity, 76 of the value; United Kingdom, 4 and 15½ per cent of quantity and value, pectively; Japan, 2.6 and 3.4 per cent. In 1915 Japan sent 561 en shears and scissors, 0.1 per cent of the quantity imported; in 6, 3,728 dozen, 2.5 per cent; in 1917, 11,588 dozen, 25 per cent.

Character.—Imports were continuous and increasing prior to the . They have been to a great extent scissors, the manufacture of ich—except for cheap cast articles—has not been successfully car- on in the United States. They are thus supplementary to the cle produced to the greatest extent in this country—shears.

Revenue.—Under the act of 1897 the revenue increased with the ease in imports, under a rate equivalent to approximately 53 per t. Under the act of 1909 it averaged approximately $293,000 per r, the rates and their ad valorem equivalent remaining the same, l imports increasing.

The act of 1913 levied a 30 per cent ad valorem duty. Under it orts have decreased, and with them revenue, on account of condi- s created by the war. The effect which the rate would have had imports and revenue, if conditions had remained normal, is some- at indicated by imports immediately following the act. During last three quarters before the outbreak of the war, October 4, 3, to June 30, 1914, imports were at a yearly rate exceeding that ained under the act of 1909 ($881,000 as against $554,000) while duty collected was at a less rate—$264,000 as against $293,000.

TARIFF HISTORY.

The acts of 1894 and 1913 levied an ad valorem duty on scissors d shears, the first one of 45 per cent, the second one of 30. The s of 1897 and 1909 each levied the same compound duties on ssors and shears and blades, on those valued at not over 50 cents dozen, 15 cents per dozen and 15 per cent ad valorem; on those lued at more than 50 cents and not more than $1.75 per dozen, cents per dozen and 15 per cent ad valorem; at more than $1.75, cents per dozen and 25 per cent ad valorem. The ad valorem uivalent of these duties was approximately 53 per cent. Since 95 duties have thus been 45 per cent; equivalent to 53 per cent 98–1914); and 30 per cent since the act of 1913.

The years 1896 and 1897, under the 45 per cent ad valorem duty of the act of 1894, show larger imports than the two following. Whether or not due to the duty, this decrease was a temporary one, and there have been increased imports since 1900. Those of the first three quarters under the act of 1913, at the 30 per cent ad valorem rate, were at a greater yearly rate than actual imports under the act of 1909.

COMPETITIVE CONDITIONS.

The United States is a manufacturer and exporter of shears, and, to some extent, of cast scissors, a very cheap article. The manufacture of forged scissors has not been successful. A portion of the shears made are "laid" shears—the cutting steel welded to the iron forming the bows and backs of the blades.

In scissors the outstanding competitor is Germany. That country early perfected a die-forging process of manufacture which enabled it to overcome English competition and has given it a preponderant position on the world market in this line of goods. In addition to its early start and the technical perfection of its processes, Germany possesses labor of the requisite skill and the advantages of organization, concentration of industry, and the reputation which attaches to its cutlery manufacture.

Japan is a new factor on the market. It sent 84 per cent of the value of the imports in 1918. Relative to Japanese and German competition after the war, a manufacturer states: "We are not familiar with conditions which existed abroad other than to know a little about prices that were made by the Germans on this class of merchandise prior to the war. Our cost figures show that labor alone—without raw materials or overhead—on solid steel scissors is in excess of the amount paid for the finished merchandise delivered at New York by Germany and Japan.

"We have been experimenting in the manufacture of scissors for the past year and a half; we find skilled labor only competent to produce these goods, and after experimenting thoroughly have found it impractical to develop any automatic operations which would offset to any degree the hand labor. Scissors and shears are produced entirely by hand operations. Of course labor conditions are extremely difficult at the present time, but we could not see how it would be possible under the most favorable labor conditions to compete either with Germany or Japan on these goods, even with greater protection than existed prior to the war, and from all the information we can gather, the percentage of scissors made in this country prior to the war was absolutely no factor in supplying our home market."

TARIFF CONSIDERATIONS.

Under the compound duties of the acts of 1909 (the same as those of 1897) the rates on the three classes formed (valued up to 50 cents per dozen; over 50 cents to $1.75; over $1.75) were equivalent to 51, 58, and 47 per cent ad valorem, respectively. The ad valorem equivalents of the rates falling on scissors and shears at values near the class limits were as follows: Valued at 50 cents per dozen, 45 per

55 cents, 106 per cent; at $1.75, 43 per cent; at $1.80, ent. Above that value the ad valorem rate decreased; at instance, it was 46 per cent. The pressure toward under-, or actual cheapening of the articles which fell in the lower he two upper classes was, on account of these great differ- rate, stronger than that induced by an ad valorem rate or all valuations.

ors, shears, and clippers—Production in United States (calendar year).

[From "Federal Census."]

ict of shear, scissor, and clipper establishments, $2,393,000; other establishments, $115,948)

Scissors and shears—Imports by countries (fiscal years).

d from—	1912		1913		1914	
	Dozens.	Value.	Dozens.	Value.	Dozens.	Value.
.....	419,373	$480,761	463,338	$527,731	575,069	$686,429
m.....	14,296	72,398	14,255	67,945	14,557	58,905
.....	1,567	7,823	1,900	6,680	3,137	11,600
.....	711	1,373	245	568	405	843
.....	119	623	74	59	198	692
.....	239	427	644	692	235	413
.....	91	575	82	254	416	605
.....	436,396	563,980	480,628	604,029	594,017	759,487

d from—	1915		1916		1917	
	Dozens.	Value.	Dozens.	Value.	Dozens.	Value.
.....	404,635	$460,675	133,308	$134,075	14,803	$16,714
m.....	10,064	51,063	7,543	41,654	6,276	31,265
.....	539	2,502	845	4,155	598	3,886
.....	41	298	175	1,012	656	3,971
.....	164	1,290	165	1,387	26	42
.....	561	920	3,728	4,566	11,588	22,292
.....	6,249	6,611	703	2,106	12,041	15,146
.....	422,253	523,359	146,467	188,955	45,988	93,316

d from—	1918		1918[1]		1919[1]	
	Dozens.	Value.	Dozens.	Value.	Dozens.	Value.
.....					55,458	$99,184
m.....	2,305	$9,639	1,142	$4,124	742	4,900
.....	270	2,492	212	2,038	150	1,366
.....	539	2,468	509	3,264	329	3,851
.....	38	129	.....	.....	263	833
.....	29,141	79,049	23,043	80,858	12,649	56,250
.....	172	485	125	539	3,243	4,289
.....	32,465	94,262	25,091	90,823	72,834	170,673

ar.

Scissors and shears—Imports for consumption—Revenue—Summary.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual equivalent
		Dozens.				Per
1907	Specific and ad valorem.	386,370	$482,251	253,937	$1.25	
1908	do	392,164	487,083	258,072	1.24	
1909	do	362,429	480,638	246,467	1.33	
1910	do	382,980	509,571	265,494	1.33	
1911	do	405,573	513,984	270,075	1.27	
1912	do	441,850	570,591	306,830	1.29	
1913	do	475,604	594,790	317,237	1.25	
1914	do	591,732	775,266	259,222	1.31	
1915	30 per cent	419,706	519,943	155,983	1.23	
1916	do	155,359	199,747	59,924	1.28	
1917	do	44,160	91,809	27,543	2.08	
1918	do	33,601	96,607	28,980	2.87	
1918[1]	do	25,350	91,317	27,395	3.60	
1919[1]	do	71,330	168,340	50,502	2.36	
1920[1]	do	211,969	518,153	155,446	2.44	

[1] Calendar years.

Scissors and shears, and blades for, valued at not more than 50 cents per dozen—I for consumption—Imports.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Dozens.				P
1908	15 cents per dozen plus 15 per cent.	122,344	$50,941	$25,992	$0.416	
1909	do	108,937	45,405	23,151	.417	
1910	do	104,315	43,355	22,150	.415	
1911	do	124,265	51,626	26,383	.415	
1912	do	107,292	46,254	23,031	.431	
1913	do	138,643	56,228	29,230	.406	
1914	do	29,908	14,499	6,661	.485	

Scissors and shears, and blades for, valued at more than 50 cents and not more tha per dozen—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ac co ad
		Dozens.				Pe
1908	15 cents per dozen plus 15 per cent.	216,604	$251,471	$146,068	$1.16	
1909	do	201,813	251,570	138,642	1.25	
1910	do	222,114	266,813	151,079	1.20	
1911	do	224,720	266,982	152,407	1.18	
1912	do	270,467	345,887	181,117	1.13	
1913	do	270,253	317,921	182,815	1.17	
1914	do	51,802	60,489	34,974	1.17	

Scissors and shears, and blades for—Imports for consumption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
.....	75 cents per dozen plus 25 per cent.	53,123	$184,670	$86,010	$3.48	46.57
.....	.....do.....	51,676	183,662	84,673	3.55	46.10
.....	.....do.....	56,550	199,397	92,262	3.53	46.27
.....	75 cents per dozen plus 25 per cent less 20 per cent.	1	5	1	5.00	32.00
.....	75 cents per dozen plus 25 per cent.	56,585	195,375	91,283	3.45	46.72
.....	.....do.....	64,090	218,449	102,680	3.41	47.00
.....	.....do.....	66,708	220,639	105,191	3.31	47.67
.....	.....do.....	12,637	39,488	19,350	3.13	49.00
.....	30 per cent.....	497,402	660,772	198,231	1.33	30.00
.....	30 per cent less 20 per cent.	3	17	4	5.67	24.00
.....	30 per cent.....	419,706	519,943	155,982	1.24	30.00
.....	.....do.....	155,359	199,747	59,924	1.29	30.00
.....	.....do.....	44,160	91,809	27,542	2.08	30.00
.....	.....do.....	33,598	96,600	28,980	2.87	30.00
.....	Free.....	3	7	.....	2.33	.....
.....	30 per cent.....	25,350	91,317	27,395	3.60	30.00
.....	.....do.....	71,330	168,340	50,502	2.36	30.00
.....	.....do.....	11,969	518,153	155,446	2.44	30.00

:eciprocity treaty with Cuba [1] From Philippine Islands. [2] Calendar years.

and shears—Imports for consumption and revenue for the given years under the different acts.

	Date.	Quantity.	Value.	Duty collected.	Value per unit (per dozen).	Actual and computed ad valorem rate.
		Dozen.				*Per cent.*
.....	1896	231,898	$292,574.29	$131,658.44	$1.26	45.00
	1897	237,989	262,240.76	118,008.33	1.10	45.00
.....	1899	187,252	206,052.60	110,509.94	1.10	53.63
	1900	245,444	253,678.86	134,772.35	1.03	53.13
	1901	250,029	294,118.05	155,595.19	1.18	52.90
	1905	272,114	340,881.43	179,072.05	1.25	52.53
	1907	386,370	482,251.45	253,936.79	1.25	52.66
	1909	362,429	480,637.59	246,667.19	1.33	51.28
ge yearly.....		432,000	553,000.00	293,000.00	1.28	52.99

and shears—Imports for consumption and revenue, Oct. 4, 1913–June 30, 1914.

Quarter.	Quantity.	Value.	Duty.
	Dozen.		
Dec. 31, 1913.....	227,965	$291,435.10	$87,429.51
Mar. 31, 1914.....	131,150	186,694.85	56,008.45
June 30, 1914.....	138,290	182,659.57	54,797.87
l.....	497,405	660,789.52	198,235.83
e.....	603,200	881,000.00	264,300.00

Scissors, shears, and blades—Imports for consumption and revenue.

UNDER ACT OF 1909, AUG. 5, 1909–OCT. 3, 1913.

Value.	Quantity.		Value.		Revenue.		Value per unit.	Computed ad valorem rate.
	Dozen.	Per cent.	Amount.	Per cent.	Amount.	Per cent.		
Not more than 50 cents per dozen..	504,424	28.02	$211,962.61	9.20	$107,458.12	8.81	$0.42	Per ct. 50.70
Over 50 cents, not over $1.75 per dozen.....	1,039,358	57.73	1,218,094.56	52.88	702,393.67	57.54	1.172	57.65
Over $1.75 per dozen	256,572	14.25	873,355.31	37.92	410,769.15	33.65	3.404	47.03
Total.....	1,800,354	100.00	2,303,412.48	100.00	1,220,620.94	100.00	1.28	52.99
UNDER ACT OF 1913, OCT. 4, 1913–JUNE 30, 1918.								
Total.....	1,150,237	.....	$1,568,895.52	.....	[1] $470,665.53	.....	$1,364	[1] 30.00

[1] $17 entered at 24 per cent from Cuba in 1914; $7 free from Philippine Islands in 1918.

Court and Treasury Decisions.

Before separate provision was made (in 1894) for *scissors* they were classified as manufactures of metal unless commercially known as cutlery. (T. D. 4785; T. D. 7509; G. A. 415, T. D. 10920.)

Surgical scissors were held dutiable as scissors under the act of 1894. (G. A. 3781, T. D. 17847.) So were scissors of manicure sets (G. A. 3136, T. D. 16307; G. A. 3428, T. D. 17047) and *manicure scissors* complete, except that the handles were stubs arranged to be fitted with longer handles; but not *finished halves of scissors*, which were classified as manufactures of metal. (G. A. 3780, T. D. 17846.) Also *lamp trimmers or snuffers* under the act of 1897, the provision for scissors being held not confined to scissors used by the seamstress. (G. A. 4321, T. D. 20450.)

Forgings useful only for finishing as scissors blades were held to be unfinished blades within paragraph 152 of the act of 1909. (Redden *v.* U. S., 5 Ct. Cust. Appls., 485.)

Steel scissors specially designed for use in pocket knives were held dutiable as scissors rather than as parts of knives under that paragraph. (Abstract 34873, T. D. 34219.)

Barbers' hair clippers are manufactures of metal and not scissors or shears for tariff purposes. (Sheldon *v.* United States, 2 Ct. Cust. Appls., 109.) They were classified as cutlery under the act of 1883. (Koch *v.* Seeberger, 30 Fed., 424.)

Hedge or pruning shears used for pruning trees and shrubbery are not agricultural implements within paragraph 391 of the act of 1913, because not chiefly used for agricultural purposes. Agriculture implements are such as are employed in pursuits that minister to human and animal subsistence; to the requirements of life (food and possibly men's comfort (raiment) and not merely pleasurable or ornamental uses. (United States *v.* Boker, 6 Ct. Cust. Appls., 245.)

But *shears* used exclusively for pruning vineyards and orchards

exempt from duty as agricultural implements. *Nuts and bolts* them are also exempt. (United States *v.* Ducommun Hardware , 7 Ct. Cust. Appls., 353.) Grape shears were classified as shears scissors under paragraph 128 rather than as agricultural imple- nts. (Abstract 41869 of 1918.)

heep shears are also exempt as agricultural implements. (United tes *v.* Irwin, 7 Ct. Cust. Appls., 360; United States *v.* Wiebusch, 364.) And onion shears, lopping shears, and grape pickers. stract 41032.)

cissors with silk tassels come within the provision for scissors. stract 43231 of 1919.) The case composed of cardboard covered silk, ornamented with rosettes, having a cord and tassel attached, found to be like the importation passed upon in Abstract 43231 ra, except that silk was the component of chief value, while in tract 43231 the scissors were of chief value, were held dutiable ntireties at 45 per cent ad valorem under paragraph 318 of the of 1913. (Abstract 43546 of 1920.)

Scissors and shears—Rates of duty.

— Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
197	Cutlery, not especially enumerated or provided for in this act, 35 per cent ad valorem.	35 per cent ad valorem.
215	Manufactures, articles, or wares, not especially enumerated or provided for in this act, composed wholly or in part of iron, steel * * * or any other metal, and whether partly or wholly manufactured, 45 per cent ad valorem.	45 per cent ad valorem.
140	* * * scissors and shears, 45 per cent ad valorem	Do.
153	Scissors and shears, and blades for the same, finished or unfinished, valued at not more than 50 cents per dozen, 15 cents per dozen and 15 per cent ad valorem.	15 cents per dozen plus 15 per cent ad valorem.
	Valued at more than 50 cents and not more than $1.75 per dozen, 50 cents per dozen and 15 per cent ad valorem.	50 cents per dozen plus 15 per cent ad valorem.
	Valued at more than $1.75 per dozen, 75 cents per dozen and 25 per cent ad valorem.	75 cents per dozen plus 25 per cent ad valorem.
152	Scissors and shears, and blades for the same, finished or unfinished, valued at not more than 50 cents per dozen, 15 cents per dozen and 15 per cent ad valorem.	15 cents per dozen plus 15 per cent ad valorem.
	Valued at more than 50 cents and not more than $1.75 per dozen, 50 cents per dozen and 15 per cent ad valorem.	50 cents per dozen plus 15 per cent ad valorem.
	Valued at more than $1.75 per dozen, 75 cents per dozen and 25 per cent ad valorem.	75 cents per dozen plus 25 per cent ad valorem.
128	Scissors and shears, and blades for the same, finished or unfinished, 30 per cent ad valorem. *Provided further*, That all articles specified in this paragraph shall, when imported, have the name of the maker or purchaser and beneath the same the name of the country of origin die-sunk conspicuously and indelibly on the blade, shank, or tang, of at least one or, if practicable, each and every blade thereof.	30 per cent ad valorem.

SWORDS, SWORD BLADES, AND SIDE ARMS.

SECTION D. CUTLERY UNIT.

Swords, sword blades, and side arms—Summary table.

Fiscal year.	Value (imports for consumption).	Amount of duty.	Equivalent ad valorem rate.
			Per cent.
1910	$19,348	$8,967	46.35
1911	31,001	14,916	48.12
1912	15,260	7,628	49.98
1913	13,771	6,883	49.98
1914	15,213	5,062	33.28
1915	6,007	1,391	23.16
1916	1,694	507	29.93
1917	2,659	798	30.01
1918	1,313	392	29.87
1918[1]	2,737	821	29.99
1919[1]	969	290	29.93
1920[1]	8,084	2,425	29.99

[1] Calenda ryear.

General Information.

PARAGRAPH 129, ACT OF 1913.

Sword blades and swords and side arms, irrespective of quality or use, in part of metal, 30 per cent ad valorem.

DESCRIPTION.

The paragraph includes foils and foil blades for fencing, as well as swords for other purposes; also bayonets, daggers, and other side arms.

DOMESTIC PRODUCTION.

The most essential of these articles is the bayonet. With the decline of the utility of the sword in military operations, and the small vogue of fencing as a sport in this country, the manufacture of swords and foils may be considered an industry of small importance.

Materials and method of production.—Crucible steel and handle materials—wood, bone, ivory, etc.—are used in the manufacture of swords.

The following is the method of manufacture used in the Royal Small Arms Factory, at Enfield, England. A bar of cast steel is hammered to double its original length under a mechanical hammer, then rolled to shape, and the tang formed under a hammer. The fins are ground off, and the blade rough ground. The blade is again heated, and a proper curve given it in a press. The heat treatment which follows consists of heating, quenching in oil, and annealing in molten lead. The final grinding follows. When finished, the blade is tested in a machine which makes it strike a blow of 120 pounds, edge and back, and 60 pounds on the flats. Bending tests follow.[1]

A recent development in the manufacture of bayonets has been the substitution of a rolling for a forging process.

[1] Encyclopedia Britannia, article "Swords".

Organization and location.—Only 8 establishments are listed in Thomas's Register of American Manufacturers (1918) as making these products. The census reports such establishments with all other cutlery manufacturers, of which there were 83 in 1914, with a capitalization of $2,581,000. What proportion of this capital was devoted to the manufacture of swords is not given.

The eight firms mentioned are located in Massachusetts, New York, and Pennsylvania.

History.—The manufacture of swords and daggers was brought to the greatest perfection of any of the cutlery processes while such articles were essential as implements of war. With the exception of the bayonet they have now lost the importance which they formerly had.

Domestic production and consumption.—Figures for production and export are not available. Prior to the war a considerable portion of the foil blades on the market were of German make.

IMPORTS.

Imports have been continuous but small. Under the act of 1909 they averaged $18,600 per year. Since 1915 they have been lower, reaching $969 in 1919 (calendar year), but increasing to $8,084 in 1920.

Under the act of 1909 the revenue amounted to $9,150 yearly, collected at a nominal rate of 50 per cent ad valorem.[1] For the three years (1915–1918) it averaged $558, collected at a nominal rate of 30 per cent.[2] In 1919 (calendar year) it amounted to $290, but increased again in 1920 to $2,425.

TARIFF HISTORY.

The duty on swords, sword blades, and side arms stood at 35 per cent ad valorem from 1883 to 1909. The act of the latter year provided a 50 per cent ad valorem duty on such articles, in part of metal irrespective of quality or use. The act of 1913 lowered this rate to 30 per cent.

Imports were continuous and small until 1896. Under the 35 per cent duty they increased, though remaining small, until 1907. In 1909, when the 50 per cent duty went into force, there was a reduction in imports. This continued low, even after the 30 per cent duty of the act of 1913 went into effect. The yearly rate of import under the first three quarters during which the act was in force was even less than the average under the act of 1909.

TARIFF CONSIDERATIONS.

Imports of swords, sword blades, and side arms are small. They have attracted no attention in the tariff hearings. There seems to be no good reason for specifying separately the articles included, rather than letting them fall under the basket clause. In the acts of 1890 and 1897 manufactures of metal bore a 45 per cent duty, 10 per cent more than the rate on swords; in that of 1894 the rate was the same; in that of 1909 swords were dutiable at 5 per cent more than manufactures of metal (45 per cent); in that of 1913, at 30 per cent, manufactures of metal (common) at 20.

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[1] Actual, on total imports, 49.18. Admission from the Philippine Islands was free and duty was remitted on swords belonging to foreign ministers.

[2] Actual, 29.30.

Swords, sword blades, and side arms—Imports for consumption—Reason.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Ad
		Number.				Pe
Fiscal year:						
1907	35 per cent		$22,268	$11,676		
1907 [1]	75 per cent of 35 per cent		28	7		
1908	35 per cent		29,220	10,229		
1908 [1]	75 per cent of 35 per cent		12	3		
1909	35 per cent		27,448	9,607		
1909 [1]	75 per cent of 35 per cent		28	9		
1910 [2]	35 per cent		4,698	1,643		
1910 [3]	40 per cent		14,562	7,825		
1910 [4]	Duty remitted		2			
1910 [5]	Free [1]		28			
1911	40 per cent		29,222	14,666		
1911 [4]	Duty remitted		577			
1911 [1]	Free		231			
1912	25 per cent		15,256	7,628		
1912 [1]	Free		5			
1913	20 per cent		13,705	6,852		
1913 [4]	Duty remitted		5			
1914 [6]	20 per cent		2,802	1,281		
1914 [6]	20 per cent		13,226	2,761		
1914 [4]	Free, C. R., art. 636		92			
1914	Free		22			
1915	20 per cent		4,625	1,281		
1915 [4]	Free, C. R., art. 636		40			
1915 [1]	Free		1,222			
1916	20 per cent		1,699	337		
1916 [7]	20 per cent-20 per cent		2			
1916 [1]	Free		2			
1917	20 per cent		3,699	738		
1918	do		1,305	262		
1918 [7]	20 per cent-20 per cent		3	1		
1918 [1]	Free		5			
Calendar year:						
1918	20 per cent		2,734	530		
1918 [7]	20 per cent-20 per cent		3	1		
1919	20 per cent	454	949	265	2.09	
1919 [7]	20 per cent-20 per cent	6	20	5	3.34	
1920	20 per cent	6,641	8,084	2,425	1.22	

[1] From Philippine Islands.
[2] July 1 to Aug. 5, 1909, under act of 1897.
[3] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[4] For use of foreign ministers.
[5] July 1 to Oct. 3, 1913, under act of 1909.
[6] Oct. 4, 1913, to June 30, 1914, under act of
[7] Reciprocity treaty with Cuba.

MISCELLANEOUS.

Swords, sword blades, and side arms—Imports and revenue under the various acts for years given.

Act of—	Year.	Value.	Duties.	Ad v rem
				Per c
1883	1884	$17,122.00	$5,922.70	
	1885	10,483.00	3,669.05	
	1889	13,347.77	4,671.70	
	1890	11,206.50	3,922.26	
1890	1893	23,853.81	8,348.84	
	1894	18,869.57	6,604.37	
	1895	12,064.98	4,222.75	
1894	1897	10,198.00	3,569.30	
1897	1899	21,062.45	7,371.86	
	1900	27,472.00	9,615.15	
	1902	30,844.50	10,795.49	
	1905	28,319.26	9,904.94	
	1907	33,384.75	11,682.41	
	1909	27,481.00	9,615.46	
1909	Yearly average	18,600.00	9,150.00	

[1] 34.9997.

...rds, sword blades, and side arms—Imports and revenue, Oct. 4, 1913 to June 30, 1914.

Quarter.	Value.	Duty.
...4 to Dec. 31, 1913	$4,048.23	$1,214.47
...1 to Mar. 31, 1914	5,019.45	1,474.33
...1 to June 30, 1914	3,583.00	1,071.90
Total	12,650.68	3,760.70
...ty rate	16,870.00	5,010.00

Court and Treasury Decisions.

Theatrical swords were held dutiable as swords. No distinction to be drawn, it was declared, between swords worn on dress parade ...d in stage displays and those to be used in fighting. (G. A. 1630, T. D. 13209.)

Swords with bone handles and bone scabbards used as ornaments or ...ios, were held dutiable as manufactures of bone under paragraph ... of the act of 1897, as not "the swords Congress had in mind." ...rimura *v.* U. S. 165 Fed. 64; T. D. 29063; G. A. 6803, T. D. 29258.)

...e words "irrespective of quality or use" and "in part of metal" ...ed in 1909 were interpreted to bring within the provision all swords ...side arms made in part of metal whatever the quality or use. ... A. 7394, T. D. 32841.)

Bayonets, pearl-handled daggers, horse pistols of antique pattern ...d unfit for use as pistols have been held dutiable as side arms. ...nerican Exp. Co. *v.* U. S., 2 Ct. Cust. Appls., 312; Abstract 38169; ...A. 5404, T. D. 24621; Abstract 22335, T. D. 30208.) Sword canes ...re also classified under that provision. (Abstract 29413, T. D. ...751), but not ornaments of copper coins in the shape of swords. ... A. 6720, T. D. 28773.)

Swords—Rates of duty.

...ct—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
...3	207	* * * swords, sword blades and side arms	35 per cent ad valorem.
...0	166	Swords, sword blades, and side arms	Do.
...4	139	....do	Do.
...7	154	....do	Do.
...0	153	Sword blades, and swords and side arms, irrespective of quality or use, in part of metal.	50 per cent ad valorem.
...3	129	....do	30 per cent ad valorem.

TABLE AND OTHER CUTLERY.

SECTION E. CUTLERY UNIT.

Table and other cutlery—Summary table.

	Domestic production.[1]	Imports for consumption.[2]	Domestic exports.[2 3]	Ratio to production.[1]	
				Imports.	Exports.
Fiscal year:		*Number.*		*Per cent.*	*Per cent.*
1910		1,887,313	$64,162		
1911		1,997,405	(5)		
1912		2,355,277	163,686		
1913		2,168,417	201,572		
1914	$8,863,000		168,623	[6] 3.76	
1915		[7] 161,108	104,386		
1916		[7] 70,154	261,810		
1917		[7] 48,967	534,129		
1918		[7] 36,704	728,232		
Calendar year:					
1918		[7] 29,980	$31,744		
1919		[7] 19,980	2,379,848		
1920		[7] 152,905			

	Value [4] (imports for consumption).	Amount of duty.[2]	Value per unit of quantity.
Fiscal year:			
1910	$192,971	$83,487	[8] $0.10
1911	198,915	86,394	[8] .10
1912	247,531	103,914	[8] .11
1913	258,011	108,718	[8] .10
1914	333,576	105,927	
1915	220,841	65,368	[7] 1.37
1916	129,234	38,182	[7] 1.84
1917	127,417	37,671	[7] 2.60
1918	116,867	34,909	[7] 3.18
Calendar year:			
1918	92,086	27,610	3.07
1919	80,532	26,812	4.49
1920	346,004	103,176	2.26

[1] Calendar year.
[2] Fiscal years ending June 30.
[3] Table cutlery only. Figures for "all other" contain shears and are therefore not comparable.
[4] Value.
[5] Figures not available.
[6] Table cutlery only, 4.72.
[7] Dozen.
[8] Each.

General Information.

PARAGRAPH 130, ACT OF 1913.

"Table, butchers', carving, cooks', hunting, kitchen, bread, but vegetable, fruit, cheese, carpenters' bench, curriers', drawing, riers', fleshing, hay, tanners', plumbers' painters', palette, arti and shoe knives, forks and steels, finished or unfinished, with handles, 25 per centum ad valorem; with handles, 30 per centum valorem: *Provided*, That all the articles specified in this paragra when imported, shall have the name of the maker or purchaser, beneath the same the name of the country of origin indelibly stam or branded thereon in a place that shall not be covered thereafter.

DESCRIPTION.

This section of the cutlery catalogue covers a larger number of articles than those enumerated above, for all articles, not treated before, which might be properly termed cutlery are included. Saws and files are the subjects of separate surveys.

The tariff of 1913 made no provision for "other" knives than those enumerated above, except that all folding knives, whether enumerated or not, fall under paragraph 128 (see section A of survey), nor did it make any provision for other articles of cutlery than those enumerated. Knives and articles of cutlery not enumerated fall under the provision for manufactures of metal (par. 167) or agricultural implements (par. 391). Nail clippers, barbers' clippers, and pruning shears enter under the first. Under the second fall sickles, scythes, sheep shears, and animal clippers. These latter articles do not require the fine finish necessary to domestic cutlery, but are made by similar processes and demand excellence of material and skillful workmanship in manufacture. The census classes clippers with scissors and shears, a logical classification, although clippers (except nail) are not made by the manufacturers of scissors and shears.

The articles omitted from the cutlery schedule (barbers' clippers, scythes, sickles, pruning shears, etc.) are sufficiently unlike those included to warrant such exclusion. The specific enumeration of knives, however, runs the risk [1] of omission of knives made in a way similar to those enumerated and even by the same companies making the former.

The following reading for paragraph 130 would include all knives, except machine knives: "Table, butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable, fruit, cheese, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', shoe knives, forks and steels, and all other knives not specially provided for in this section, except knives for use in machines, finished or unfinished, without handles,—per centum ad valorem; with handles,—per centum ad valorem."

Plated ware has been substituted to a large extent for table cutlery made of steel. The former is not treated in this catalogue. Blanks for subsequent plating are made to some extent by the manufacturers of cutlery and sold to establishments doing the plating.

DOMESTIC PRODUCTION.

Table cutlery, because of the extended use of plated and silverware, is not of as great importance as formerly; the product of this industry plus that of all other [2] cutlery and edge tools was valued at $8,900,000 in 1914.

Materials.—Steel—crucible, open-hearth, or Bessemer—is the principal material used in the manufacture of table cutlery and knives. The material for the handles varies from wood and composition metals or materials to ivory, mother of pearl, and the precious metals.

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[1] The "Cutlery Makers of America," 1918, classifies separately manufactures of candy knives, chicken killing knives, fish knives, clam knives, and oyster knives, none of which are mentioned by the tariff.

[2] Shoe knives, oyster knives, paper hangers' knives, hunting and special knives, cutting dies, skiving knives, swords, etc.

An alloy of 12 to 13 per cent chromium with a low-carbon steel has recently been introduced, and in the United Kingdom its use is becoming extensive. This alloy has pronounced rust-resisting qualities, without losing those properties which make steel preeminent as a cutlery metal.

Equipment.—As for other cutlery products, equipment for forging, heat treating, and grinding is necessary. The machines used in grinding are semiautomatic.

Methods of production.—Table cutlery: Some of the cheaper grades are cast, often for subsequent plating. The better blades are rolled, or forged under the trip hammer. The carving fork is forged; other forks are frequently simply stamped from sheet metal.

The grinding process is semiautomatic. A box holds six blades against the grinding stone, moving them in such a way against the stone as to give the desired edge and finish. Final grinding, giving the cutting edge, is done by hand.

Other cutlery. The production of butchers', kitchen, and other knives is similar to that of table knives.

A scythe is formed as a shear, with a cutting edge of blister or shear steel welded to an iron back. The latter gives the weight and rigidity necessary for the heavy work. Another form is made of a thin sheet of cast steel, cut with shears to the correct shape, and riveted to an iron rib along the back. A sickle is similarly formed by welding and forging.

Organization.—The production of table cutlery, as carried on in the United States, is better adapted to large factory organization than other branches of cutlery. In 1914, 27 firms had a capitalization of $9,134,000, the largest average capitalization of any of the branches of the cutlery industry. The firms listed as manufacturing "all other" cutlery show quite the reverse condition: Eighty-three firms have a capitalization of only $2,581,000.

Geographical distribution.—Of the 91 firms, 19 are located in New York, 18 in Connecticut, 17 in Massachusetts, 8 in Pennsylvania, 7 each in Ohio and New Jersey, the remaining 15 being scattered in 8 other States. The lists for other cutlery products show a greater concentration of establishments in New York.

History.—The manufacture of table cutlery in this country began in 1832 at Saccarappa, Me. Since plated ware is better fitted to American methods of production, its manufacture has been developed and plated goods have, to a large extent, occupied the place formerly held by steel table cutlery.

Domestic production and consumption.—The domestic production of table and other cutlery was $8,863,000 in 1914; imports, $333,600; exports, $676,000. The latter figure is not comparable with the others, for a portion of it is formed of shears and pocket knives. Exports of table cutlery were $168,623, imports $260,377. On that date the United States did not produce table cutlery equal to the domestic consumption. As to "other" cutlery, little information is to be derived from the figures. Knives of various kinds are exported—to Canada, Brazil, and Argentina, for instance. European manufacturers have a larger share of these markets, however, than the United States. We export sickles and scythes to the Canadian market, clippers, sheep shears, and pruning shears to

ath America. These articles are not included in the import ures for cutlery.

Domestic exports.—Exports of table cutlery averaged $178,000 for e three years 1912–1914, $300,000 for 1915–1917. In 1918, ports were valued at $728,232, and in 1919 (calendar year) to ,379,848. During the first period, Brazil took 33 per cent, Canada Cuba 7, and Argentina 5; during the second, Brazil took 20 per nt, Canada 19, Argentina 11, and Cuba 9. The increase has been neral, but largest to North and South America.

Exports to foreign markets come into competition with English, erman, and French goods.

FOREIGN PRODUCTION.

The principal foreign producers are the United Kingdom, Germany, d France. Japanese table cutlery has not been sold in as rapidly creasing quantities on the United States markets as other kinds Japanese cutlery.

IMPORTS.

Quantity.—Imports are stated for table cutlery and various ecified knives. In the fiscal year 1910, 1,900,000 articles were ported, valued at $193,000. Imports were greater each year til 1914, when they reached a value of $333,600. Since that te they decreased steadily until 1920, imports in the calendar year 19 being only 19,960 dozen, valued at $89,532. In 1920 they in-eased to 152,905 dozen valued at $346,004.

Varieties.—During the five fiscal years 1910–1914, 72½ per cent of e value of these imports was table cutlery, the remaining certain ecified knives, forks, and steels. During the years 1915–1918, the rcentage of table cutlery was slightly less. Under the acts of 1897 d 1909, both of these classifications were divided according to the terial of which the handle was made. Those without handles, on which the duty did not amount to a certain per cent (45 per t, act of 1897; 40, act of 1909), made up the bulk of the import. der the act of 1913, which divided only according as the knives or did not have handles, 12.4 per cent of those imported, up to ne 30, 1918, were without handles.

Source.—General imports are included in general imports of "all ier" cutlery. These statistics[1] specifically exclude the articles ated in the previous sections, except swords. During the three al years preceding the outbreak of the war, the United Kingdom nished 40 per cent of this import; Germany, 38 per cent; France, During the next four years, with imports greatly reduced be-use of war conditions, the United Kingdom sent 63 per cent, Ger-any, 16 per cent, and France, 14. Japan's share had increased m 0.6 per cent during the first period to 2 per cent during the cond. In 1918 the United States imported $4,500 worth of "other" tlery from this country—3.7 per cent of the total imports.

Revenue.—Under the act of 1909, which provided less rates than e preceding, an average revenue of $96,000 was collected on table tlery and the enumerated knives, forks, and steels, at rates equiv-nt to 43 per cent ad valorem. Under the act of 1913, which pro-

[1] 1912 and after.

vided a duty of 30 and 25 per cent, according as the articles ent with or without handles, the revenue has been less on smaller i ports. During the first three quarters in which the act of 1913 w in force, prior to the outbreak of the war, imports came in at greater yearly rate than under the previous act, and even at lower duties, the yearly rate at which revenue was collected dur these quarters was $109,000, somewhat higher than the yearly av age under the preceding act.

TARIFF HISTORY.

The act of 1894 laid a duty of 45 per cent ad valorem on table an carving knives and forks valued at more than $4 per dozen piec and 35 per cent on all other table knives, forks, and steels, on vari enumerated knives, and on cooks' and butchers' knives, forks, an steels. Cutlery articles not enumerated (clippers, scythes) wou bear the latter rate of duty as manufactured articles of metal. T following act drew up a similar list of knives, forks, and steels an provided compound duties varying according to the material of th handle. These articles were dutiable at 15 per cent ad valorem pl 16 cents apiece if with handles of mother-of-pearl, shell, or ivory: 1 cents if with handles of deer horn: 5 cents if with handles of har rubber, solid bone, celluloid, or any other pyroxyline material: 1 cents if with handles of other material. Where these duties did no amount to 45 per cent ad valorem, the articles were made dutiabl at that figure. Articles or wares of metal not specially provided fo entered under the latter rate.

The acts of 1909 and 1913 enlarged the list, so that it read: "Table butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable fruit, cheese, carpenters', bench, curriers', drawing, farriers', fleshing hay, tanners', plumbers', painters', palette, artists', and shoe knives forks, and steels, finished or unfinished." These acts also provided that these articles, when imported, should have the name of the maker or purchaser, and beneath it the name of the country of origin branded or stamped indelibly upon the article, in a place not later covered. The act of 1909 laid compound duties according to the material of the handles: 15 per cent on all with handles, and in addition, on those with handles of mother-of-pearl, shell, ivory, and metal, other than iron or steel, 14 cents each; of deer horn, 10 cents each; of hard rubber, solid bone, celluloid, or any pyroxyline material, 4 cents; of other material, 1 cent.

Knives on which these compound duties did not equal 40 per cent ad valorem paid that rate under the act of 1909, as did knives without handles. Cutlery not provided for (such as clippers) would enter at 45 per cent ad valorem as articles or wares of metal. The act of 1913 provided ad valorem duties of 30 and 25 per cent according as the knives, forks, or steels were imported with or without handles. Paragraph 391, providing for the free admission of agricultural implements, covers scythes, sickles, sheep shears, and similar tools for agricultural use.

Larger importations have followed a decrease in the rates. Under the act of 1897, which provided rates equivalent to approximately 50 per cent, imports increased gradually, and under the act of 1909, providing rates equivalent to 42½ per cent, imports were larger each

successive year, averaging 2,177,000 pieces, valued at $226,000 yearly. During the first three quarters in which the act of 1913 was in force, just prior to the war, the yearly rate of import, under ad valorem duties of 25 and 30 per cent (equivalent to approximately 29½ per cent on actual importations), was still higher—320,000 dozen, valued at $369,000. Conditions arising from the war since that time have obscured the effects of the rate itself upon imports.

The increases in the imports of table cutlery are more pronounced than in the imports of the enumerated knives, forks, and steels.

COMPETITIVE CONDITIONS.

Steel table cutlery has been to a great extent superseded in the United States by plated ware, to the production of which American factory methods have been more applicable than to steel table cutlery. The United Kingdom sends a much larger proportion of the table and other cutlery imported into the United States than of the articles of cutlery already treated;[1] in fact, the value is approximately equal to the import from Germany.

Import statistics of Chile and Argentina [2] represent the conditions on these markets. For the years 1912 and 1913 Germany sent 49 per cent of the Chilean import of knives and forks, the United Kingdom 38 per cent, and the United States 7½ per cent. For the years 1913 and 1914 Germany sent 45 per cent of the Argentine import of table cutlery, France 25 per cent, the United Kingdom 17 per cent, and the United States 4.6 per cent. Of knives, Germany sent 86 per cent, the United States less than 0.3 per cent, France and the United Kingdom 4 per cent each. Of the scythes and sickles imported into Chile (1912–13) the United States sent 2.6 per cent; of the pruning and clipping shears, 6.2 per cent. The United Kingdom furnished the bulk of the imports in the first case, and divided with Germany in the second. The United States lead in barber's clippers, furnishing 62.1 per cent of the Chilean imports, against the United Kingdom's 16 per cent, Germany's 12 per cent; also in sheep shears, furnishing 73.5 per cent of the Argentine imports, against the United Kingdom's 25.9 per cent and Germany's 0.3 per cent.

On the Canadian [3] markets imports from the United States are handicapped, as against British goods, by the preferential tariff. The Canadian statistics are not classified in a way to make the big items comparable with our figures. In the year ended March 31, 1914, the United States sent 96.5 per cent of the hay and straw knives imported, 87 per cent of the edging knives, 77 per cent of the scythes, and 27 per cent of the sickles and reaping hooks. A few scythes came in from Austria-Hungary and Sweden; otherwise the United Kingdom was the only other exporter of these articles to Canada.[4]

TARIFF CONSIDERATIONS.

The wording for paragraph 130 given under "Description" (p. 71) would avoid the difficulty arising from the enumeration of the many knives included without provision for knives not enumerated.

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[1] Pen and pocket knives, razors, scissors, and shears.
[2] These markets took 7.8 per cent of our exports of table and other cutlery, 1912-1914.
[3] Canada took one-fifth of our exports of table and other cutlery, 1913–14.
[4] *See "Total cutlery" for further statements in regard to these markets.*

Table cutlery—Production in United States (calendar year).

[From Federal Census.]

1914	[1] $5,657,000

Other cutlery and edge tools [2]—Production in United States.

[From Federal Census.]

Calendar year 1914	[3] $3,228,000

Cutlery, all other [1] (dutiable [2])—Imports, by countries (fiscal years).

Imported from—	1910 [3]	1911 [3]	1912	1913	1914	1915	1916	1917	1918
France	$52,752	$58,797	$43,249	$57,976	$60,894	$33,770	$15,800	$18,094	$18,289
Germany	1,311,903	1,443,838	95,622	100,460	145,479	86,518	10,335	407	.....
United Kingdom	380,311	421,231	102,908	107,592	136,027	100,289	96,330	101,241	88,623
Austria-Hungary	41,522	40,597	5,167	4,655	3,262	843	.....	.....	.....
Sweden	5,181	11,049	4,653	1,901	2,966	1,109	1,441	982	629
Canada	1,035	1,499	964	1,311	1,058	1,189	285	873	282
Japan	2,445	2,492	2,081	1,983	1,861	1,736	2,498	2,994	4,514
All others	7,884	13,141	5,235	2,649	3,988	3,794	3,500	5,197	7,222
Total	1,803,033	1,992,644	259,879	278,527	355,535	229,250	130,349	133,758	125,709

[1] Other than pen or pocket knives, razors, scissors, and shears, 1912 and after.
[2] Not including imports from Philippine Islands (free): 1911, $588; 1912, $5; 1914, $22; 1915, $1,631; 1916, $2.
[3] All cutlery.

Cutlery, all other (dutiable)—Imports, by countries (calendar years).

Imported from—	1918	1919
France	$15,729	$12,779
Germany	.....	881
United Kingdom	69,603	63,173
Austria-Hungary	.....	.....
Sweden	583	671
Canada	229	232
Japan	5,907	6,495
All other	5,432	7,109
Total	97,504	90,539

Table cutlery—Imports for consumption—Revenue—Summary.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Number.*				*Per cent.*
1907	Various	1,259,015	$107,857.93	$56,969	[a] $0.086	52.82
1908	....do	1,101,851	101,162.03	51,959	[a] .092	51.36
1909	....do	783,763	52,599.25	28,477	[a] .0671	54.14
1910	....do	1,486,288	135,279.44	59,256	[a] .091	43.80
1911	....do	1,500,041	134,843.42	59,822	[a] .09	44.36
1912	....do	1,791,209	165,360.95	69,995	[a] .092	42.32
1913	....do	1,958,667	190,877.40	80,482	[a] .097	42.16
1914	....do	.....	267,377.11	84,698	.....	31.68
		Dozen.				
1915	....do	131,848	175,348.00	51,879	[b] 1.331	29.59
1916	....do	45,914	81,992.00	24,059	[b] 1.786	29.34
1917	....do	30,216	81,799.00	24,122	[b] 2.707	29.49
1918	....do	19,302	71,258.00	21,313	[b] 3.692	29.91
Calendar year:						
1918	....do	13,088	45,979.00	13,788	[b] 3.513	29.99
1919	....do	8,000	43,435.00	13,019	[b] 5.429	29.96
1920	....do	101,514	241,832.00	72,243	[b] 2.382	29.99

[a] Each. [b] Dozen.

[1] Product of table cutlery establishments, $5,606,000; other cutlery and edge tool establishments, $45,300; establishments not cutlery nor edge tool, $7,300.
[2] Shoe knives, oyster knives, paper hangers' knives, hunting and special knives, cutting dies, skiving knives, swords, etc.
[3] Other cutlery and edge tool establishments (excluding table cutlery; razors; axes and hatchets; scissors, shears, and clippers; pocket knives; augers, bits, chisels and planes), $2,445,000; other cutlery products, produced by the above excluded groups, $185,161; other cutlery products, produced by establishments not edge tool nor cutlery establishments, $575,998.

Cutlery, all other—Imports for consumption—Revenue—Summary.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
Fiscal year:		*Number.*				*Per cent.*
1907	Various	436,470	$66,977	$30,218	$0.15	45.12
1908	do	354,900	49,339	22,577	.14	45.76
1909	do	280,231	42,020	20,021	.15	52.33
1910	do	401,025	57,692	24,239	.14	42.00
1911	do	497,364	64,072	26,772	.13	41.78
1912	do	564,068	82,170	33,919	.15	41.28
1913	do	509,750	67,133	28,234	.13	42.06
1914	do	111,067	66,198	21,229	.60	32.07
		Dozen.				
1915	do	29,258	45,293	13,489	1.55	29.78
1916	do	24,240	47,242	14,124	1.95	29.90
1917	do	18,751	45,618	13,549	2.43	29.70
1918	do	17,402	45,609	13,597	2.62	29.81
Calendar year:						
1918	do	16,892	46,107	13,822	2.73	29.98
1919	do	11,960	46,097	13,793	3.85	29.92
1920	do	51,391	104,172	30,933	2.02	29.69

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, and steels, finished or unfinished, with handles of mother-of-pearl, shell, or ivory—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	16 cents per piece and 15 per cent.	12,562	$4,740	$2,721	$0.377	57.40
1908	do	5,391	2,297	1,207	.426	52.55
1909	do	2,799	1,102	613	.394	55.64
1909 [1]	16 cents per piece and 15 per cent less 20 per cent.	2	1	.....	.50	38.00
1910 [2]	16 cents per piece and 15 per cent.	312	90	63	.288	70.38
1910 [3]	14 cents each and 15 per cent.	12,044	2,106	2,002	.175	95.05
1911	do	1,661	631	327	.380	51.85
1912	do	5,555	2,119	1,096	.381	51.70
1913	do	1,039	380	202	.367	53.28
1914 [4]	do	180	62	35	.344	55.65

[1] Reciprocity treaty with Cuba.
[2] July 1 to Aug. 5, 1909, under act of 1897.
[3] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[4] July 1 to Oct. 3, 1913, under act of 1909.

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, and steels, finished or unfinished, with handles of silver, nickeled silver, and other metal than iron or steel—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duties collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	14 cents each and 15 per cent.	4,574	$1,407	$852	$0.308	60.50
1911	do	30,759	5,660	5,155	.184	91.08
1912	do	12,485	3,672	2,299	.294	62.59
1913	do	16,154	5,809	3,068	.341	56.04
1914 [2]	do	2,862	951	543	.332	57.13

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, and steels, finished or unfinished, with handles of deerhorn—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	12 cents per piece and 15 per cent.	31,277	$7,863	$4,933	$0.251	62.73
1908	do	47,732	10,750	7,340	.225	68.28
1909	do	16,179	4,022	2,545	.249	62.27
1910[1]	do	473	144	78	.305	54.62
1910[2]	10 cents each and 15 per cent.	17,667	2,891	2,200	.163	76.11
1911	do	12,757	3,519	1,804	.276	51.25
1912	do	13,403	3,728	1,900	.278	50.95
1913	do	12,782	4,057	1,887	.317	46.51
1914[3]	do	9,191	1,655	1,167	.198	70.51

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, and steels, finished or unfinished, with handles of hard rubber, solid bone, celluloid, or any pyroxyline material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Valur per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	5 cents per piece and 15 per cent.	26,764	$3,537	$1,869	$0.132	52.83
1908	do	24,091	2,976	1,651	.123	55.47
1909	do	21,793	2,863	1,519	.131	53.06
1910[1]	do	1,536	195	106	.127	54.36
1910[2]	4 cents each and 15 per cent.	22,733	2,549	1,292	.112	50.68
1911	do	33,505	3,967	1,935	.118	48.78
1912	do	21,822	2,422	1,236	.111	51.03
1913	do	17,228	2,114	1,006	.123	47.60
1914[3]	do	5,845	603	324	.103	53.73

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, and steels, finished or unfinished, with handles of any other material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	1½ cents per piece and 15 per cent.	917,427	$25,283	$17,554	$0.028	69.43
1908	do	561,812	16,596	10,917	.029	65.77
1909	do	537,197	14,445	10,225	.027	70.78
1910[1]	do	61,657	1,723	1,183	.028	68.68
1910[2]	1 cent each and 15 per cent.	591,921	18,125	8,638	.031	47.66
1911	do	690,839	19,736	9,869	.029	50.00
1912	do	694,314	19,381	9,850	.028	50.82
1913	do	739,840	18,505	10,174	.025	54.98
1914[3]	do	140,435	3,763	1,969	.027	52.32

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, steels, finished or unfinished—Other, on which ordinary duty would not amount per cent—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	45 per cent.....	270,721	$66,405	$29,882	$0.245	45.0
.....	75 per cent of 45 per cent.	154	9	3	.058	33.75
.....	45 per cent less 20 per cent.	110	20	7	.182	36.0
.....	45 per cent.....	462,813	68,539	30,843	.148	45.0
.....	45 per cent less 20 per cent.	12	3	1	.278	36.0
.....	45 per cent.....	205,793	30,166	13,575	.147	45.0
.....	.....do.....	47,248	8,451	3,803	.179	45.0

Philippine Islands.
rocity treaty with Cuba.
to Aug. 5, 1909, under act of 1897.

carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, teels, finished or unfinished, without handles, and other on which ordinary duty not amount to 40 per cent—Imports for consumption—Revenue.

l year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	40 per cent.....	726,120	$97,596	$39,039	$0.134	40
.....	.....do.....	730,520	101,330	40,532	.139	40
.....	.....do.....	1,043,615	134,035	53,614	.128	40
.....	40 per cent less 20 per cent.	15	2	1	.133	32
.....	40 per cent.....	1,171,623	160,311	64,124	.137	40
.....	.....do.....	259,410	37,811	15,124	.146	40

, 1909, to June 30, 1910, under act of 1909.
ocity treaty with Cuba.
to Oct. 3, 1913, under act of 1909.

arving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives, forks, eels, finished or unfinished, without handles—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
ır:		*Dozens.*				*Per cent.*
.....	25 per cent.....	25,075	$24,026	$6,007	$0.958	25
.....	.....do.....	16,042	15,699	3,925	.978	25
.....	.....do.....	8,570	10,446	2,612	1.219	25
.....	.....do.....	5,222	8,348	2,087	1.599	25
.....	.....do.....	664	1,724	431	2.597	25
year:						
.....	.....do.....	57	112	28	1.97	25
.....	.....do.....	241	225	56	.94	25
.....	.....do.....	5,323	6,127	1,532	1.15	25

1913, to June 30, 1914, under act of 1913.

Table, carving, cooks', kitchen, bread, butter, vegetable, fruit, and cheese knives and steels, finished or unfinished, with handles—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.
		Dozens.			
Fiscal year:					
1914 [1]	30 per cent	182,080	$196,426	$59,526	$1.09
1914 [2]	Free, article 636, C. R.	5	77		15.40
1915	30 per cent	116,806	129,849	47,955	1.37
1915 [2]	Free, article 636, C. R.	4	55		13.75
1916	30 per cent	37,340	71,491	21,447	1.92
1917	do	24,994	73,451	22,035	2.94
1918	do	16,738	43,985	13,196	2.62
Calendar year:					
1918	do	13,031	45,985	13,760	3.51
1918 [3]	30 per cent less 20 per cent.		2		
1919	30 per cent	7,750	43,210	12,963	5.57
1920	do	96,191	285,705	70,711	2.46

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.
[2] For use of foreign ministers.
[3] Reciprocity treaty with Cuba.

Butchers', hunting, plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of mother-of-pearl, shell, or ivory—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.
		Number.			
1907	16 cents per piece, and 15 per cent.	160	$69	$36	$0.431
1908	do	830	287	176	.346
1909	do	2,625	1,053	578	.40

Butchers', hunting, plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of deer horn—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.
		Number.			
1907	12 cents per piece, and 15 per cent.	72	$11	$10	$0.153
1908	do	5,749	1,270	880	.221
1909	do	14,071	2,896	2,123	.206

Butchers', hunting, plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of hard rubber, solid bone, celluloid, or any pyroxylin material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.
		Number.			
1907	5 cents per piece and 15 per cent.	726	$72	$47	$0.10
1908	do	1,094	124	73	.113
1909	do	8,862	1,150	616	.130

Butchers', hunting, plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of any other material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	1½ cents per piece and 15 per cent.	10,039	$322	$199	$0.032	61.64
1908	....do	25,965	1,292	583	.049	45.13
1909	....do	20,440	726	416	.036	57.22

Butchers', hunting, plumbers', painters', palette, artists', and shoe knives, finished or unfinished, other on which ordinary duty would not amount to 45 per cent—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1907	45 per cent	425,453	$66,502	$29,926	$0.156	45.00
1908	....do	321,272	46,366	20,865	.144	45.00
1909	....do	234,233	36,196	16,288	.155	45.00

Butchers', hunting, carpenters', bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters, palette, artists', and shoe knives, finished or unfinished, with handles of mother-of-pearl, shell, or ivory—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	6 cents per piece and 15 per cent.	1	$1	.....	$1.00	31.00
1910 [2]	4 cents each and 15 per cent.	730	332	$152	.455	45.78
1911	....do	223	74	42	.332	57.16
1912	....do	722	141	122	.195	86.69
1913	....do	1,294	115	198	.089	172.53
1914 [3]	....do	30	7	5	.26	68.85

[1] July 1 to Aug. 5, 1909, under act of 1877.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

Butchers', hunting, carpenters', bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of silver, nickeled silver, or other metal than iron or steel—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	14 cents each and 15 per cent.	198	$64	$37	$0.323	58.31
1911	....do	5,815	1,818	1,087	.313	59.78
1912	....do	3,474	1,265	676	.364	53.45
1913	....do	1,305	499	258	.382	51.61
1914 [2]	....do	12	4	2	.333	57.00

[1] Aug 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Butchers' hunting, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, with handles of deer horn—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	12 cents per piece and 15 per cent	1,514	$205	$212	$0.135	103.41
1910 [2]	10 cents each and 15 per cent	6,528	2,028	957	.311	47.19
1911	do	6,664	1,937	956	.291	49.40
1912	do	8,938	2,578	1,281	.288	49.67
1913	do	8,714	2,574	1,286	.295	49.96
1914 [3]	do	1,131	322	161	.285	50.12

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

Butchers', hunting, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of hard rubber, solid bone, celluloid, or any pyroxylin material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	4 cents each and 15 per cent	65,187	$7,743	$3,769	$0.119	48.68
1911	do	69,819	9,046	4,150	.129	45.87
1912	do	71,664	9,288	4,260	.13	45.86
1913	do	97,899	12,112	5,733	.124	47.33
1914 [2]	do	17,785	2,126	1,030	.12	48.45

[1] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[2] July 1 to Oct. 3, 1913, under act of 1909.

Butchers', hunting, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, finished or unfinished, with handles of any other material—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
1910 [1]	1½ cents per piece and 15 per cent	4,812	$109	$89	$0.023	81.2
1910 [2]	1 cent each and 15 per cent	28,434	1,100	449	.038	40.8
1911	do	24,302	741	354	.03	47.8
1912	do	21,042	757	324	.036	42.9
1913	do	28,688	933	427	.032	45.7
1914 [3]	do	1,530	52	23	.034	44.6

[1] July 1 to Aug. 5, 1909, under act of 1897.
[2] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[3] July 1 to Oct. 3, 1913, under act of 1909.

', hunting, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', ers', painters', palette, artists', and shoe knives, finished or unfinished, and n which ordinary duty would not amount to 45 per cent—Imports for consump- Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	45 per cent.....	15,945	$2,409	$1,084	$0.151	45.00

1909, to June 30, 1910, under act of 1909.

', hunting, carpenters' bench, curriers', drawing, farriers', fleshing, hay, tanners', ers', painters', palette, artists', and shoe knives, finished or unfinished, without s, and other on which ordinary duty does not amount to 40 per cent—Imports for nption—Revenue.

year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Number.				*Per cent.*
.....	40 per cent.....	277,676	$43,701	$17,480	$0.157	40.00
.....	.....do.....	390,541	50,456	20,182	.129	40.00
.....	.....do.....	458,228	68,141	27,256	.149	40.00
.....	.....do.....	371,850	50,900	20,360	.137	40.00
.....	.....do.....	57,684	9,501	3,801	.165	40.00

g. 6, 1909, to June 30, 1910, under act of 1909. [1] July 1 to Oct. 3, 1913, under act of 1909.

', hunting, carpenters' bench, without handles—Imports for consumption— Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
r:		*Dozen.*				*Per cent.*
.....	25 per cent.....	1,010	$986	$247	$0.976	25
.....	.....do.....	1,654	1,946	487	1.177	25
.....	25 per cent less 20 per cent.	12	25	5	2.084	20
.....	25 per cent.....	1,172	980	245	.836	25
.....	.....do.....	1,748	2,724	681	1.558	25
.....	.....do.....	664	1,724	431	2.596	25
year:						
.....	.....do.....	69	214	54	3.102	25
.....	.....do.....	267	721	180	2.70	25
.....	.....do.....	5,791	6,354	1,588	1.10	25

Oct. 4, 1913, to June 30, 1914, under act of 1913. [1] Reciprocity treaty with Cuba.

', hunting, carpenters' bench, with handles—Imports for consumption—Revenue.

	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
r:		*Dozen.*				*Per cent.*
.....	30 per cent.....	31,885	$53,200	$15,960	$1.67	30
.....	.....do.....	27,592	43,322	12,997	1.57	30
.....	.....do.....	23,068	46,262	13,879	2.01	30
.....	.....do.....	17,003	42,893	12,868	2.52	30
.....	30 per cent less 20 per cent.	.....	1	.....	.....	24
.....	30 per cent.....	16,738	43,885	13,166	2.62	30
year:						
.....	.....do.....	16,823	45,893	13,768	2.73	30
.....	.....do.....	11,693	45,376	13,613	3.88	30
.....	.....do.....	45,600	97,818	29,345	2.14	30

Oct. 4, 1913, to June 30, 1914, under act of 1913. [1] Reciprocity treaty with Cuba.

Table cutlery—Domestic exports.

FISCAL YEARS.

Exported to—	1910	1911 [1]	1912	1913	1914	1915	1916	1917	1918
Brazil	$12,938	.....	$50,144	$68,852	$57,066	$25,890	$32,932	$120,342	[illegible]
Canada	12,226	.....	27,841	24,409	31,870	24,778	50,169	102,252	[illegible]
Cuba	5,837	.....	12,001	16,199	10,478	11,983	25,647	49,541	[illegible]
Argentina	2,047	.....	10,286	7,905	9,277	1,651	28,749	68,648	[illegible]
Mexico	7,387	.....	10,294	7,503	1,430	1,667	3,004	15,156	[illegible]
All other	23,727	.....	53,120	76,704	58,502	38,417	121,309	178,190	[illegible]
Total	64,162	.....	163,686	201,572	168,623	104,386	261,810	534,129	[illegible]

CALENDAR YEARS.

Exported to—	1918	1919	Exported to—	1918	1919
Denmark	$6,811	$140,661	Brazil	$193,441	[illegible]
Norway	16,195	225,037	Chile	59,272	[illegible]
United Kingdom	35	79,026	Australia	12,621	[illegible]
Canada	55,979	80,670	All other	209,154	[illegible]
Mexico	42,686	97,273			
Cuba	108,067	113,142	Total	831,744	2,379,[illegible]
Argentina	127,483	289,593			

[1] Included in "All other cutlery."

Cutlery, all other [1]—Domestic exports (fiscal years).

Exported to—	1910 [1]	1911 [2]	1912 [1]	Exported to—	1910 [1]	1911 [2]	1912 [1]
Germany	$62,947	$52,556	$33,806	British India	$29,854	$47,206	[illegible]
United Kingdom	135,225	205,924	258,122	Australia	[3] 42,280	72,582	[illegible]
Canada	109,089	123,231	175,666	France	13,054	13,505	[illegible]
Mexico	28,772	37,836	28,572	All other	222,466	257,405	[illegible]
Cuba	45,710	52,304	40,094				
Argentina	52,175	72,074	68,271	Total	842,521	1,083,891	[illegible]
Brazil	100,049	149,176	48,654				

[1] Other than table cutlery. [2] All cutlery. [3] And Tasmania.

Cutlery, all other [1]—Domestic exports.

FISCAL YEARS.

Exported to—	1913	1914	1915	1916	1917	1918
Germany	$51,801	$49,103	$3,306	.....	.....	.....
United Kingdom	76,981	46,564	511,531	$559,476	$169,907	[illegible]
Canada	132,951	102,870	118,581	311,566	590,411	[illegible]
Mexico	21,020	11,654	8,587	15,155	51,970	[illegible]
Cuba	23,715	24,556	26,192	90,066	173,027	[illegible]
Argentina	23,786	19,129	8,084	56,862	134,735	[illegible]
Brazil	21,598	8,103	17,123	59,134	147,388	[illegible]
British India	39,287	58,824	37,944	79,789	94,465	[illegible]
Australia	32,253	38,523	38,105	54,592	104,480	[illegible]
France	2,379	2,833	13,512	58,198	53,726	[illegible]
All other	146,841	144,961	135,614	425,165	633,948	[illegible]
Total	572,612	507,120	918,579	1,710,003	2,154,057	[illegible]

CALENDAR YEARS.

Exported to—	1918	1919	Exported to—	1918	1919
Germany	.....	$2,751	Chile	$130,442	[illegible]
United Kingdom	$110,741	302,922	British India	64,313	[illegible]
Canada	606,781	674,854	Australia	128,326	[illegible]
Mexico	83,751	136,452	Philippine Islands	137,361	[illegible]
Cuba	248,005	159,605	All other	569,493	[illegible]
Argentina	186,388	317,533			
Brazil	247,154	385,859	Total	2,499,775	[illegible]

[1] Other than razors and table cutlery.

Table, butchers', etc., knives, forks, and steels—Imports for consumption and revenue for specified years under the various acts.

Act of—	Date.	Quantity.	Value.	Duty.	Value per unit of quantity.	Computed ad valorem rate.
		Dozen.				*Per cent.*
1890	1893	98,053	$195,669.51	$105,349.89	$2.00	53.84
1894	1894	65,632	124,557.72	66,728.06	1.90	53.57
	1897	148,697	283,525.56	106,834.52	1.91	37.68
		Number.				
1897	1899	826,355	113,450.33	56,015.43	.137	49.37
	1900	1,099,518	129,014.35	65,394.36	.117	50.61
	1902	1,062,457	140,739.59	69,575.92	.132	49.44
	1905	913,491	125,290.16	62,899.58	.137	50.20
	1907:					
	Table cutlery	1,239,015	107,857.93	56,968.85	.086	52.82
	Knives	436,450	66,977.51	30,218.41	.154	45.12
	Total	1,695,465	174,835.44	87,187.25	.103	49.87
	1909:					
	Table cutlery	783,763	52,599.25	28,476.95	.067	54.14
	Knives	280,231	42,020.50	20,019.95	.150	47.64
	Total	1,063,994	94,619.75	48,496.90	.087	51.25
1909	Yearly average:					
	Table cutlery	1,692,000	159,000.00	68,000.00	.094	42.88
	Knives	485,000	67,000.00	28,000.00	.135	41.66
	Total	2,177,000	226,000.00	96,000.00	.104	42.52

Table, butchers', etc., knives, forks, and steels—Imports for consumption and revenue, by quarters, Oct. 4, 1913, to June 30, 1914.

Period and kind.	Dozen.	Value.	Duty.
Oct. 4–Dec. 31, 1913:			
Table cutlery	84,448	$96,685.46	$28,386.29
Knives	19,797	30,622.50	9,167.90
Jan. 1–Mar. 31, 1914:			
Table cutlery	57,477	59,948.65	17,743.89
Knives	7,278	13,607.50	4,075.20
Apr. 1–June 30, 1914:			
Table cutlery	65,236	65,897.00	19,404.75
Knives	5,821	9,956.10	2,963.43
Total (9 months):			
Table cutlery	207,161	222,531.11	65,534.93
Knives	32,896	54,186.10	16,206.53
Total	240,057	276,717.21	81,741.46
Yearly rate:			
Table cutlery	276,000	297,000.00	87,400.00
Knives	44,000	72,000.00	21,600.00
Total	320,000	369,000.00	109,000.00

Table and other cutlery—Imports for consumption and revenue under the act of 1909, Aug. 6, 1909, to Oct. 3, 1913.

	Quantity.	Value.	Duty.	Value per unit.	Computed ad valorem rate.
	Number.				*Per cent.*
Table cutlery	7,042,902	$660,604.21	$283,284.59	$0.094	42.88
Various knives, forks, and steels	2,028,107	280,356.80	116,792.35	.135	41.66
Total	9,071,009	940,961.01	400,076.94	.104	42.52

Court and Treasury Decisions.

The term *"fruit knives"* in paragraph 140 of the act of 1894 was held more specific than the term *"table knives"* in the same paragraph. (G. A. 3537, T. D. 17275.) *Sets of knives, forks, and spoons*, about the size of the ordinary articles, were held not to be toys. (G. A. 3772, T. D. 17838.)

A 6-inch knife, with a 5-inch folding blade which fastened with a spring lock, was classified as a hunting knife because commercially so known. (U. S. *v.* Borgfeldt, 1 Ct. Cust. Appls., 255.)

Knives known as *camping knives*, provided with a cutting blade, a fork, and a spoon, all of which are hinged so as to fold into or alongside of the handle, and so constructed that they can be separated into three parts and the parts separately used, too large to be carried in the pocket and usually carried in baskets, are not pocketknives, but dutiable under paragraph 155 of the act of 1897. Knives similarly constructed, but having only a cutting blade and a fork, of the size and character of a pocketknife and capable of being carried in the pocket, were held dutiable as pocketknives at the appropriate rates according to value under the provisions of paragraph 155. (T. D. 25335, G. A. 5693.)

Bowie knives are a species of hunting knife and dutiable under paragraph 155 of that act. The fact that such knives are carried at the side does not throw them into the category of articles known as side arms, and they are not dutiable under paragraph 154. If known both as hunting knives and side arms, bowie knives were held dutiable at the highest rate of duty by virtue of section 7. (T. D. 24606, G. A. 5399.)

Vegetable cutters.—A parer and corer used in grating, slicing, and peeling vegetables and made of tin with a handle of wood was held a not a knife within the cutlery provisions of the act of 1909. (Abstract 25168, T. D. 31450.)

Tables knives having handles of iron or steel over which a thin sheet or shell of celluloid is laid were held properly classified as knives with handles of celluloid or pyroxylin under paragraph 154 (Abstract 29399, T. D. 32751); also one-piece table knives as well as forks (Abstract 38611, of 1915).

One-piece forks.—The provision in paragraph 154 for "knives, forks, and steels, finished or unfinished; if imported with handles of * * * other metal than iron or steel," was held not limited to such finished articles as have handles added thereto, but included as well a fork in which the handle and tines are made of one piece. (T. D. 30488, G. A. 7002.)

Nickel-plated handles.—Carving knives and forks of steel with handles coated or plated with nickel, assessed at 14 cents each and 15 per cent ad valorem, under the provisions of paragraph 154, were claimed dutiable under the same paragraph at 1 cent each and 15 per cent ad valorem. Protest overruled. (Abstract 33983, T. D. 33833.)

Kitchen knives.—Kitchen or vegetables knives having affixed to the blades thereof a removable attachment designed to regulate the thickness of the vegetable peeling desired, classified as manufactures of metal under paragraph 199, were held dutiable as vegetable or kitchen knives (par. 154). Protest overruled as so-called radish

ves being vegetable slicers composed of a flat piece of steel with cutting edge and a spiral or screw attachment working with a ary movement, classified under paragraph 199. (Abstract 25061, D. 31405 cited; Abstract 34944, T. D. 34247.)

Marking.—Carving knives, forks, and steels imported in sets must individually marked, as required by paragraph 130 of the act of 3. (Department order, T. D. 34384.) Articles specified in paraphs 128 and 130, of Japanese production, are legally marked with name of the country of origin when marked with the word ippon" provided they are also marked with the name of the ker or purchaser. (Department order, T. D. 37828.)

The article which is commonly and commercially known and recized as a *butcher's cleaver*—a chopping tool used by butchers for itting bones—is not a knife, and is therefore not covered by the vision in paragraph 130, for "butchers' knives" as classified by collector, but is dutiable rather as a manufacture of metal not cially provided for under paragraph 167 of the act of 1913. (G. A. 5, T. D. 37879.)

Hay-knife plates have been properly classified under the provision this paragraph for hay knives, finished or unfinished, without ndles, rather than as agricultural implements under paragraph 391 manufactures of metal under paragraph 167. (Abstract 40371, 916.)

Finished shoe knives without handles, requiring an improvised handle, wn in commerce as shoe knives without handles, are so dutiable, not as shoe knives with handles. (Abstract 40268, of 1916.)

Cleaver-shaped knives constructed and designed for use by Chinese ks in cutting boneless meat into strips and cubes are "cooks' ves" within this paragraph. (G. A. 8264, T. D. 38054, of 1919.)

The classification covers table cutlery and certain other specified ds of knives, forks, and steels. No provision is made for "all er knives" or "all other cutlery," and knives not specified would s fall under manufactures of metal (par. 167).

Table, tea, and other spoons, silverware usually packed with knives forks, are dutiable at 50 per cent ad valorem under paragraph , as against 25 or 30 per cent on knives and forks of silver or er plate; and such articles as sloyd, linoleum, and fish knives are o dutiable under paragraph 167, but at 20 per cent, which is less an the rates imposed on other knives in paragraph 130. The following changes might be made in this paragraph: Strike out the word nd" after the word "artists';" insert the words "and similar" tween the words "shoe" and "knives;" substitute a semicolon for comma after the word "knives" and after the words "forks and els;" insert the words "all the foregoing" followed by a comma er the words "forks and steels" and insert the words "and not cially provided for in this section" followed by a semicolon after word "unfinished." This would make the provision read after word "artists'": "shoe and similar knives; forks and steels; all foregoing, finished or unfinished, and not specially provided for this section; without handles, [rate]; with handles, [rate]." The viso also might be changed by omitting the words "when imrted," because rendered unnecessary by the omission of the words n and after October first, nineteen hundred and nine," in the act

of 1909, and tending to forbid the right to mark the name of t maker or purchaser, etc., on the goods while in customs custody aft importation.

Table and other cutlery—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, spec and ad valorem.
1883	197	Cutlery, not especially enumerated or provided for in this act, 35 per cent ad valorem.	35 per cent ad valor
1890	107	Table knives, forks, steels, and all butchers', hunting, kitchen, bread, butter, vegetable, fruit, cheese, plumbers', painters', palette, and artists' knives of all sizes, finished or unfinished, valued at not more than $1 per dozen pieces, 10 cents per dozen.	10 cents per dozen.
		Valued at more than $1 and not more than $2, 35 cents per dozen.	35 cents per dozen.
		Valued at more than $2 and not more than $3, 40 cents per dozen.	40 cents per dozen.
		Valued at more than $3 and not more than $8, $1 per dozen	$1 per dozen.
		Valued at more than $8, $2 per dozen	$2 per dozen.
		And in addition upon all the above-named articles, 30 per cent ad valorem.	30 per cent ad valo additional.
		All carving and cooks' knives and forks, of all sizes, finished or unfinished, valued at not more than $4 per dozen pieces, $1 per dozen.	$1 per dozen.
		Valued at more than $4 and not more than $8, $2 per dozen pieces.	$2 per dozen piece
		Valued at more than $8 and not more than $12, $3 per dozen pieces.	$3 per dozen piece
		Valued at more than $12, $5 per dozen pieces	$5 per dozen piece
		And in addition upon all the above-named articles, 30 per cent ad valorem.	30 per cent ad valo additional.
1890	215	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or any other metal, and whether partly or wholly manufactured, 45 per cent ad valorem.	45 per cent ad valo
1894	140	Table and carving knives and forks, valued at more than $4 per dozen pieces * * *, 45 per cent ad valorem.	Do.
		All other table knives, forks, steels, and all hunting, kitchen, bread, butter, vegetable, fruit, cheese, plumbers', painters', palette, and artists' knives; also all cooks' and butchers' knives, forks and steels, 35 per cent ad valorem.	35 per cent ad valo
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured, 35 per cent ad valorem.	Do.
1897	155	Table, butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable, fruit, cheese, plumbers', painters', palette, artists', and shoe knives, forks and steels, finished or unfinished, with handles of mother-of-pearl, shell or ivory, 16 cents each.	16 cents each.
		With handles of deer horn, 12 cents each	12 cents each.
		With handles of hard rubber, solid bone, celluloid, or any pyroxyline material, 5 cents each.	5 cents each.
		With handles of any other material than those above mentioned, 1¼ cents each.	1¼ cents each.
		And in addition, on all the above articles, 15 per cent ad valorem.	15 per cent ad va additional.
		Provided, That none of the above-named articles shall pay a less rate of duty than 45 per cent ad valorem.	45 per cent ad valo
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or other metal, and whether partly or wholly manufactured, 45 per cent ad valorem.	Do.
1909	154	Table, butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable, fruit, cheese, carpenters', bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, forks and steels, finished or unfinished if imported with handles of mother-of-pearl, shell, ivory, silver, nickeled silver, or other metal than iron or steel, 14 cents each.	14 cents each.
		With handles of deerhorn, 10 cents each	10 cents each.
		With handles of hard rubber, solid bone, celluloid, or any pyroxyline material, 4 cents each.	4 cents each.
		With handles of any other material than those above mentioned, 1 cent each.	1 cent each.
		And in addition, on all the above articles, 15 per cent ad valorem.	15 per cent ad va additional.
		Any of the knives, forks, or steels enumerated in this paragraph, if imported without handles, 40 per cent ad valorem.	40 per cent ad va
		Provided, That none of the above-named articles shall pay a less rate of duty than 40 per cent ad valorem:	Do.
		Provided, That all the articles specified in this paragraph when imported on and after Oct. 1, 1909, shall have the name of the maker or purchaser and beneath the same the name of the country of origin indelibly stamped or branded thereon in a place that shall not be covered thereafter.	

Table and other cutlery—Rates of duty—Continued.

'ar.	Tariff classification or description.	Rates of duty, specific and ad valorem.
199	Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or other metal, and whether partly or wholly manufactured, 45 per cent ad valorem.	45 per cent ad valorem.
130	Table, butchers', carving, cooks', hunting, kitchen, bread, butter, vegetable, fruit, cheese, carpenters', bench, curriers', drawing, farriers', fleshing, hay, tanners', plumbers', painters', palette, artists', and shoe knives, forks and steels, finished or unfinished, without handles, 25 per cent ad valorem.	25 per cent ad valorem.
	With handles, 30 per cent ad valorem.....	30 per cent ad valorem.
	Provided, That all the articles specified in this paragraph, when imported, shall have the name of the maker or purchaser, and beneath the same the name of the country of origin indelibly stamped or branded thereon in a place that shall not be covered thereafter.	
167	Articles or wares not specially provided for in this section, if composed wholly or in part of platinum, gold, or silver, and articles or wares plated with gold or silver, and whether partly or wholly manufactured, 50 per cent ad valorem.	50 per cent ad valorem.
	If composed wholly or in chief value of iron, steel, lead, copper, brass, nickel, pewter, zinc, aluminum, or other metal, but not plated with gold or silver, and whether partly or wholly manufactured, 20 per cent ad valorem.	20 per cent ad valorem.

FILES, FILE BLANKS, RASPS, AND FLOATS.

SUMMARY.

Files and rasps to the value of $5,608,000 were produced in the United States in 1914. Pennsylvania, Rhode Island, and New Jersey are among the leading producing States. Imports are small compared with domestic production and exports. In 1914 imports were valued at $101,949, the highest figure reached in any year from 1907 to 1920, and equal to 1.82 per cent of domestic production in that year. Most of the files imported from 1908 to 1913 were less than 7 inches long. Exports in 1919 were valued at $3,681,457, and in 1919 at $4,725,655. These exports were widely distributed in the markets of the world, where American files have competed successfully with foreign-made files for many years.

Before the war Germany, Austria, and England were the leading foreign producers. High-grade files were also made in France, Sweden, and Switzerland. Most of the files imported in 1919 came from Switzerland.

Prior to 1913 files were dutiable at specific rates varying with the length of the file. During the period 1907–1913 the average equivalent ad valorem rate of these duties varied from a maximum of 79.35 per cent in 1909 to a minimum of 59.36 per cent in 1913. By the act of 1913 the duty on files was substantially reduced to a uniform ad valorem rate of 25 per cent.

Files, file blanks, rasps, and floats.—Summary table.

Year.[1]	Domestic production.	Imports for consumption.	Domestic exports.	Ratio of imports to production.	Value (imports for consumption).	Amount of duty.	Value per dozen.	Actual or equivalent ad valorem rate.
		Dozens.		*Per cent.*				*Per cent.*
1909	$5,691,000							
1910		80,312.90			$64,295	$13,699	$0.799	60.8
1911		73,802.12			60,298	40,550	.898	61.5
1912		68,162.66			62,094	37,548	.911	60.4
1913		60,453.08			55,076	32,092	.911	59.3
1914	5,608,157	121,786.53		[2] 1.82	101,949	30,557	.837	29.9
1915		46,884.00			38,590	9,648	.823	25.0
1916		64,591.00			43,021	10,755	.666	25.0
1917		72,884.00			61,132	15,283	.839	25.0
1918		54,616.00	[3] $3,681,457		59,903	14,976	1.097	25.0
1919		26,086.00	4,725,655		37,325	9,331	1.431	25.0
1920 [4]		83,197.00			100,471	25,118	1.231	25.0

[1] Production calendar years; imports and exports, fiscal years.
[2] Percentage based on values.
[3] Not specified prior to 1918; quantity not stated.
[4] Calendar year.

General Information.

TARIFF PARAGRAPH, ACT OF 1913.

PAR. 131. Files, file blanks, rasps, and floats, of all kinds and cuts, 25 per cent ad valorem.

DESCRIPTION.

A file is a metal tool (usually steel) used for abrading, reducing, or smoothing metal, ivory, wood, marble, or other resistant materials. Files are used so widely and for such various purposes that they must be produced in almost infinite variety.

Files and rasps have three distinguishing features: (1) Their length (2) their shape or kind; and (3) their cut. The length of a file is the distance between the heel or part where the tang begins and the point, or opposite end. The tang is the part of the file prepared for the reception of the handle. Generally speaking, files range from 3 to 20 inches in length.

In shape, with reference to the cross section, a file may be flat, round, triangular, square, or irregular. It may also be blunt or taper. The term "blunt" designates a file that preserves its sectional shape and size throughout from point to tang. The term "taper" designates a file the point of which is more or less reduced in size (both width and thickness) by a gradually narrowing section extending from one-half to two-thirds the length of the file from the point.

The cut of files is divided with reference to the shape of the teeth into single cut, double cut, and rasp cut; and with reference to the coarseness of the teeth generally into rough, coarse, bastard, second cut, smooth, and dead smooth. The single-cut file is one in which a single unbroken course of chisel cuts is made across the surface, arranged parallel to each other, but oblique to the center line or axis of the file. The double-cut file has two courses of chisel cuts crossing each other, the second course with rare exceptions being finer than the first. The rasp cut differs from single and double cut in the respect that the teeth are made by a pointed tool called a punch, not by a chisel, and consist of points or burrs rather than lines or sharp ridges.

Regarding the coarseness of the teeth, it may be said that the coarse and bastard cuts are used upon the heavier classes of work, while the second cut and smooth are used for finer work and for finishing the work started by the coarse and bastard cuts. The rough (coarsest) and the dead smooth (finest) are seldom called for in ordinary work.

The foregoing description does not cover certain special types of files, such as diesinkers' files, diesinkers' and silversmiths' rifflers, needle files, and escapement files. Some of these tools have a cutting surface only an inch or less in length, are curved instead of straight as ordinary files, and have teeth finer than the ordinary dead-smooth file. The American Swiss File & Tool Co., for example, making a specialty of such files, produces files with cuts numbered 00 to 8. No. 3 or 4 corresponds to the common dead-smooth file. Nos. 5–8 are finer. Small files are often referred to as Swiss-pattern files. The term "Swiss" as applied to files is a survival from the small Swiss files which, produced in Switzerland for the native watch industry, were in former years exported from that country in large quantities.

A file blank is a file in process of manufacture before being cu
A rasp is a species of file in which each tooth is an angular pit
a strong burr formed by a pointed punch, instead of a long fu
formed by a broad-bladed chisel. (See "rasp cut" above).
The coarser grades of single-cut files are not infrequently c
floats when cut for use by plumbers or for use upon soft meta
wood. The tool used by shoemakers to rasp the ends of pegs i
boots or shoes is called a float.

DOMESTIC PRODUCTION.

Materials.—The chief material required is steel in the for
bars of various sizes according to the different types of files.
Equipment.—Machines are used in various processes in the m
facture of files. The most important machine is the one devise
cutting the teeth.
Methods of production.—Wallace L. Pond, of the Nicholson
Co., testifying before the Committee on Ways and Means in
stated that each file from the time it is cut from a bar of spe
rolled steel until it is placed in the finished stock ready for shi
must pass through from 20 to 26 processes or operations and
be handled from 75 to 90 times. Machinery is used to perfor
principal operations, but the making of files is not an auto
process. Each machine requires one or two attendants, a
many cases the operation includes only one file at a time.
skilled workmen, together with a small number of helpers and
ers, are employed. Consequently the percentage of labor c
high. Mr. Pond presented to the committee exhibits to illu
his point, showing that the cost of the steel required in the p
tion of files, particularly in small files, was but a small part
selling price of the files.
The following is a brief digest of a detailed description o
cesses used by the American Swiss File and Tool Co., of Elizabet
N. J., as printed in the tariff hearings of 1913:

The raw material for files comes in the shape of crucible steel bars. The s
of operations is as follows:
Shearing to length, annealing, forming, grinding to size, draw-filing, cuttin
hardening, cleaning, tempering, inspecting, and packing. For most of the
ations special machinery has superseded the old hand process, although ha
machine work go on side by side at certain stages.
Shearing is the process of cutting from the bar stock a blank of the proper l
form the completed file. An ordinary bar shear is used. It is provided wit
to determine the length of the blank.
Annealing is the process of treating the file blanks by means of heat to remo
brittleness and to give them a uniform hardness, a quality of fundamental imp
for successful machine cutting.
Forming is the process of bringing the file blank to the approximate shape
of the finished file. This is done by means of drop hammers and dies.
Grinding consists in removing the scale left on the blank from the foregoi
ation. All files with flat surfaces can be ground in semiautomatic machin
certain other shapes, as half rounds, the machine is not so successful and ha
gives the best results.
Draw-filing is an operation supplementing grinding in preparing the blank
ting. It produces a greater fineness of surface than grinding. A machine h
devised for draw-filing flat surfaces, but the round, half round, and similar
must still be finished by hand.
Cutting may be by the chisel process or by the etching process. By the first
the blank is struck successive blows with a chisel with its edge ground to a
shape, so that when a cut is made, the surrounding metal is raised to form a

the proper shape. This operation is now performed by file-cutting machines. A file-cutting machine consists of a moving table on which the file blank is fixed, and which moves it progressively under a sort of trip-hammer arrangement, carrying cutting chisels. During this process the file is held by the machine at the point and the tang, and the point is therefore left uncut. Except in cheap files the points are later cut by hand.

In the etching process the metal is cut out between the teeth by means of a cutting tool, leaving the edges of the teeth in the original surface of the blank, instead of raised out of it, as in the chisel cutting process. A machine has been devised which dispenses with one of the two men formerly required for the operation. The etching process produces a much higher grade of file than the chisel-cutting process.

The hardening process requires two operators, a boy to insert the files into a lead bath and a workman to remove them when at the proper temperature and plunge them into a tank of brine.

Cleaning is the process of removing from the file a film of oxide left as a result of the hardening operation. A special apparatus has been designed which subjects the files, one at a time, to the action of water holding fine grit in suspension discharged against them with force.

Organization.—The census of 1914 reports 48 establishments engaged in the production of files, with a capital of $11,327,000, and employing 4,349 wage earners. The value of the product was $5,608,000. Of the wage earners employed, 2,058, or 47.3 per cent, were employed in three establishments, each having more than 501 wage earners; 1,230, or 28.3 per cent, in three establishments having 251 to 500 wage earners; and 221, or 5.1 per cent, in two establishments having 101 to 250 wage earners. In other words, 80.7 per cent of all wage earners in the industry were employed in eight establishments, each with more than 100 wage earners.

Of the total product, $4,965,000, or 88.5 per cent, was produced in 11 establishments, each with an output valued at $100,000 or more.

Mr. Wallace L. Pond, representing the Nicholson File Co., testified before the Committee on Ways and Means in 1913 that his firm produced $4,000,000 worth of files in 1911. This, he believed, was 50 per cent to 54 per cent of total domestic production. He based his opinion on the number of wage earners employed by the Nicholson File Co. as compared with the total number in the industry. He questioned the accuracy of the census figures of 1909, saying he thought they were too low. Under the census system of classification, Henry Disston & Sons, one of the largest file producers in the country, would be assigned to the saw industry, its chief product being saws.

It appears from the foregoing that the file industry is largely in the hands of a relatively few producers. It is evident that the industry requires production on a moderately large scale for the best results, making possible the widest use of machinery and specialization of labor. While the value of the product increased from $2,487,000 in 1879 to $5,608,000 in 1914, the number of establishments decreased from 179 to 48.

The roster of the Hardware Manufacturers' Association for war service (1918) lists 43 manufacturers of files in the United States.

Geographical distribution.—The census of manufactures of 1914 does not clearly indicate the geographical distribution of the industry. It shows production valued at $1,495,000 in Pennsylvania, $207,000 in Massachusetts, $203,000 in New York, $189,000 in Ohio, and $3,514,000 in all other States, including under that head Connecticut, Illinois, Indiana, Michigan, New Jersey, Rhode Island, and Wis-

consin. Since the plants of the Nicholson File Co. are located at Providence, R. I., Anderson, Ind., and Paterson, N. J., we may safely put Rhode Island, Indiana, and New Jersey among the leading file-producing States.

History of the industry.—File-cutting machines were invented as early as 1699, but did not prove commercially successful until Mr. W. T. Nicholson, of Providence, R. I., invented and applied in 1865 a machine which, as modified and improved from time to time, is now extensively used in the United States. In 1869 the value of files produced in the United States was $1,649,000. Successive decennial periods showed substantial increases, until in 1909 the value of the product was $5,691,000. The census of 1914 showed a slight decrease to $5,608,000. Since that date the value of the product has increased, the value of the files and rasps exported alone having been $4,725,655 in 1919.

Domestic production and consumption.—Domestic production in 1914 was valued at $5,608,000. Imports in that year were valued at $101,949, or less than 2 per cent of production. Exports in 1918, the first year for which official export statistics are available amounted to $3,681,457, as against imports in that year valued at $59,903. Exports have been large for many years. The Nicholson File Co., the largest producer, exported 12 per cent to 18 per cent of its output during the last six years prior to 1913 and has since continued to export heavily. It is evident from the foregoing that domestic production of files is in excess of domestic consumption.

Domestic exports.—Official export statistics are not available prior to the year 1918, when exports of files and rasps were valued at $3,681,457. In that year exports to the value of $1,653,933 went to Europe, $418,814 to North America, including the West Indies, $404,425 to South America, $610,842 to Asia, $501,957 to Oceania, and $91,486 to Africa. The five leading countries were: Italy, $975,454; British India, $385,713; Australia, $374,888; England, $235,933; and Russia in Europe, $186,490. In 1919 exports were valued at $4,725,655.

FOREIGN PRODUCTION.

Before the war, Germany and Austria were our leading competitors in quantity produced, and England (Sheffield goods) was our leading competitor for quality. High-grade files were produced in England, France, Germany, Austria, Sweden, and Switzerland. Several years before the war the three largest Swiss manufacturers combined their interests, forming one large corporation, which with its standardized methods and modern efficiency became an important factor in world production. The largest and most progressive file makers in European countries employed up-to-date machinery and methods of production.[1]

The census of 1907 of the United Kingdom shows production of files and rasps in the United Kingdom to the value of £615,000, equivalent to $2,993,000. Statistics of production of other foreign countries are not available.

The following information on foreign production and markets is taken from the series of reports issued by the Department of Com-

[1] Foregoing statements based upon information supplied by David Halstead, president of the Delta File Works, Philadelphia, and Wallace L. Pond, sales manager of the Nicholson File Co.

merce during 1916 and 1917 on markets for American hardware in various foreign countries. Unfortunately, the text of those reports does not indicate clearly the date of the conditions described; apparently the date varies from 1914 to 1916:

In Germany, domestic factories entirely supplied the general demand for files in the principal trades, especially the demand for cast-steel files which were produced in exceedingly good quality. Germany imported files only from the United States and Switzerland, the latter country furnishing the so-called "Swiss" files for watchmakers, electricians, etc., and special files for dentists. In 1913 Germany exported files and rasps to the value of $1,218,200 and imported to the value of $178,600. Taking into consideration this excess of exports over imports amounting to more than $1,000,000, and the necessarily great consumption of files by German industry, it is evident that Germany produced files on a large scale.

In Sweden, American files had formerly been sold in large quantities, but the domestic manufacturers had made special efforts to drive the American file from the Swedish market. Swedish producers had succeeded in producing what is known as an "armored file," for which great merits are claimed. It has deep semicircular cuts, which make it possible to file down material three times as fast as with an ordinary file. It can be sharpened three times with advantage. It is said to outlast three to five regular files. It cleans itself and can be used on metal, wood, or stone, always leaving a smooth surface. (Exports of American files and rasps to Sweden in 1918 amounted to only $882.)

In Russia, two factories were making files and rasps, one in Petrograd and the other in Riga. The industry was protected by a high duty. There was a big demand for files and the United States had a good share of the business, owing mainly to the quality of the American file. Germany did a good business in low-grade files, and a fair number of English and French files were sold. Most of the American files sold in Russia were of the smaller sizes.

Import statistics of nonproducing countries throw some light on competitive conditions. We may note, for example, that Australian demand for files was practically wholly supplied by the United States, although the English product was encouraged by a 10 per cent preferential duty.

Chile formerly had imported files and rasps mainly from Germany and England, Germany leading in the quantity sold. Recently the German product had been displaced by American files and rasps—the latter being cheaper and packed in cardboard boxes, thus making it easier for the retailer to handle them. The German article was wrapped in paper and tied up with a string. Two or three American houses did about 60 per cent of the business in files and rasps in Chile.

In Brazil the American files had also made great headway, their progress in that market, as in Chile, having been due in part to their being packed in cardboard boxes instead of wrapped in paper parcels like the European product.

IMPORTS.

Imports have been small compared with domestic production and exports. Only once in the 12 years, 1907–1918, did imports attain a value of $100,000 a year. That was in 1914 when $121,786

dozen files valued at $101,949 were imported. The value of imports in that year amounted to 1.82 per cent of domestic production. The smallest imports in the 12-year period 1907–1918 were 37,942 dozen, valued at $27,803, in 1909. In 1919 imports amounted to only 26,086 dozen, valued at $37,324. Imports fluctuate from year to year. Most of the files imported have been under 7 inches in length. The tariff act of 1909 was said by Mr. E. P. Reichhelm at tariff hearings in 1913 to have encouraged the importation of high-grade Swiss and German files and to have practically excluded files of the ordinary kind from our market.

Most of the files imported during the six months from July to December, 1919, at New York came from Switzerland. Imports were as follows: Total imports, $23,282; imports through the port of New York, $21,563; imports from Switzerland through the port of New York $21,149. The files imported from Switzerland consisted mainly of files used by jewelers and others who require files for delicate work. Few of them were over 6 inches long. It is generally admitted that the files imported from Switzerland are of high quality. Opinions differ as to whether or not they are better than similar American-made files. Some jewelers prefer them to American-made files, assert that they do better work, and insist upon having them, although they cost more than American-made files. One importer states that Swiss files cost the retailer 10 per cent to 20 per cent more than American-made files. Another asserts that the difference is greater.

PRICES.

The wholesale price of the 8-inch mill bastard Nicholson file averaged $0.92 per dozen during each of the years 1913, 1914, and 1915. In 1915 the average yearly price rose to $1.05; in 1917, to $1.37; and in 1918, to $1.64 per dozen. The wholesale price of 16-inch horse rasps, plain, remained fixed at $4.068 per dozen during 1913, 1914, 1915, and 1916. In 1917 the yearly average price was $4.636 and in 1918 $5.167 per dozen.

The average monthly, quarterly, and yearly prices of these two articles for 1913 are shown in table "Files, 8-inch mill bastard Nicholson," infra.

TARIFF HISTORY.

The act of 1894 imposed duties on files, file blanks, rasps, and floats of all cuts and kinds, which varied with the length of these articles from $0.35 to $1 per dozen, the lowest rate applying to files 4 inches in length and under, and the highest rate applying to all files 9 inches in length or over.

The act of 1897 increased the number of classes from three to four and in effect increased the duties, although the rates specified were $0.30 to $1 per dozen.

During the last three years under the operation of the act of 1897—1907, 1908, and 1909—imports were 106,769 dozen, 81,675 dozen, and 37,942 dozen, respectively. The value of these imports decreased even more rapidly from $86,653 in 1907 to $27,803 in 1908. The duty collected fell from $64,725 in 1907 to $22,061 in 1909. The average computed ad valorem rate for the three years 1907–1909 was 75.5 per cent.

ıe act of 1909 retained the classification of the act of 1897 and ced the rates to $0.25 per dozen on files 2½ inches in length or ır, $0.77½ on files 7 inches in length or over, and the intermediate ; in proportion.

the fiscal year 1910, during the last 11 months of which the law with its lower duties was in effect, imports were 80,313 n, valued at $64,206 and paying a duty of $43,699, as against ırts of 37,942 dozen, valued at $27,803 and paying a duty of 061, in 1909, the last year under the old law. Imports de- sed gradually after 1910, however, until in 1913 they were only 53 dozen, valued at $55,076, paying a duty of $32,692. The age value of imports 1907–1909 was $60,000 and the average of duty 75.5 per cent. The average value of imports 1911–1913 $61,000 and the average rate of duty 60.3 per cent.

ıe act of 1913 reduced the duty on files, etc., to a uniform ad ·em rate of 25 per cent. In the fiscal year 1914, during the last months of which the new tariff was in effect, imports were 87 dozen, valued at $101,949 and paying a duty of $30,557. represented an increase over the last year the old law was in ; of 101 per cent in quantity and 85 per cent in value. After however, imports fell and during 1915–1918 ranged from a mum of 46,884 dozen, valued at $38,590 in 1915, to a maximum ,884 dozen, valued at $61,132 in 1917.

COMPETITIVE CONDITIONS.

ıerican file producers have practically supplied the domestic ·et for many years and have done a substantial export business. ırts have been negligible as compared with domestic produc- and have consisted mainly of files less than 7 inches in length. ırts have been heavy, but official statistics are lacking prior to . In 1918 the value of files and rasps exported was $3,681,457. ng the six years prior to 1913 the Nicholson File Co., the largest rican producer, exported 12 per cent to 18 per cent of its out- or 600,000 to 750,000 dozen files per year. American exports been widely distributed and have successfully met the direct ıetition of German, French, English, and other files in various gn markets, as in Russia, Australia, Chile, Brazil. The suc- of American producers is based on the use of up-to-date meth- and machinery and the economies in large-scale production. ›rocess of making files is not a wholly automatic one, but much -saving machinery can be used. The most progressive for- producers, however, also use up-to-date methods and machinery, their competition is feared by American producers, who point eir lower wage scales. Labor costs are several times as great w material costs in the file industry, and any substantial differ- in wages in favor of foreign producers must be met by Ameri- nanufacturers by means of superior organization and efficiency oduction. To illustrate the importance of labor costs as com- l with raw material costs, Wallace L. Pond, of the Nicholson Co., exhibited to the Committee on Ways and Means in 1913 nch round file. He stated that 1 pound of steel costing 25 would make 83 dozen such files, having a value of $68.06. arger files the relative cost of raw material is naturally greater.

TARIFF CONSIDERATIONS.

Specific duties on files varying only with the length of the file irrespective of quality, such as the duties applied by the act of 1[illegible] and earlier acts subject a large low-grade file to a higher duty than a small high-grade file, although the latter might be the more expensive. If it should be considered desirable to substitute specific duties for the present ad valorem rate, some distinction should be made between low-grade files and high-grade files.

Files—Production in United States.

[From Federal census.]

	Value.
1899	$3,[illegible]
1904	4,[illegible]
1909	5,[illegible]
1914	5,[illegible]

Files—Production in United States—States.

[From Federal census.]

1914:	Value.
Pennsylvania	$1,[illegible]
Massachusetts	20[illegible]
New York	20[illegible]
Ohio	18[illegible]
Connecticut	19[illegible]
All other [1]	3,[illegible]
Total	5,608,[illegible]

Files and rasps—Production in principal foreign countries.

1907:	Value.
United Kingdom [2]	$2,903,[illegible]

Files, file blanks, rasps, and floats, 2½ inches in length and under—Imports for consumption—Records.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per dozen.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
1907	30 cents per dozen.	13,[illegible]18	$4,052	$1,025	$0.[illegible]39	[illegible].29
1908	do	10,021	4,039	3,007	.405	[illegible].45
1909	do	6,079	1,857	1,824	.305	[illegible].98
1910 [a]	do	881	388	264	.440	[illegible].12
1910 [b]	25 cents per dozen.	9,584	2,494	1,545	.379	[illegible].00
1911	do	7,119	2,683	1,780	.377	[illegible].38
1912	do	6,[illegible]19	2,498	1,580	.385	[illegible].58
1913	do	7,623	3,110	1,903	.408	[illegible].12
1914 [c]	do	2,786	958	697	.344	[illegible].23

[a] July 1 to Aug. 5, 1909, under act of 1897.
[b] Aug. 6, 1909, to June 30, 1910, under act of 1909.
[c] July 1 to Oct. 3, 1913, under act of 1909.

[1] All other States embrace: Illinois, 3; [illegible]; Indiana, 1; Michigan, 2; New Jersey, 6; Rhode Island, 4; Wisconsin, 1.
[2] Census of the United Kingdom 1907.

, file blanks, rasps, and floats, over 2½ inches and not over 4½ inches in length—Imports for consumption—Revenue.

ıscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per dozen.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
	50 cents per dozen.	44,440	$28,484	$22,220	$0.596	83.90
	do	37,098	22,304	18,549	.601	83.17
	do	17,307	9,994	8,654	.577	86.59
	do	2,803	1,606	1,402	.573	87.27
	47½ cents per dozen	32,224	19,551	15,307	.607	78.29
	do	23,561	18,461	14,041	.625	76.06
	do	28,572	17,438	13,572	.61	77.83
	do	25,113	14,231	11,929	.566	83.92
	do	5,130	3,056	2,437	.596	79.73

aly 1 to Aug. 5, 1909, under act of 1897.
ug. 6, 1909, to June 30, 1910, under act of 1909.
aly 1 to Oct. 3, 1913, under act of 1909.

s, file blanks, rasps, and floats, over 4½ and under 7 inches in length—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per dozen.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
	75 cents per dozen.	41,724	$36,919	$31,293	$0.885	87.47
	do	27,549	26,675	20,662	.968	77.46
	do	11,889	11,164	8,917	.939	79.87
1	do	2,027	1,996	1,520	.985	76.17
2	62½ cents per dozen	28,599	26,876	17,875	.940	66.51
	do	26,940	25,340	16,838	.940	66.45
	do	22,594	21,156	14,121	.936	66.75
	do	17,488	15,710	10,930	.899	69.62
3	do	4,871	4,530	3,044	.93	67.21

uly 1 to Aug. 5, 1909, under act of 1897.
ug. 6, 1909, to June 30, 1910, under act of 1909.
uly 1 to Oct. 3, 1913, under act of 1909.

es, file blanks, rasps, and floats, 7 inches in length and over—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual and computed ad valorem rate.
		Dozens.				*Per cent.*
	$1 per dozen	7,187	$18,298	$7,187	$2.55	33.81
	do	7,006	12,458	7,006	1.78	56.24
	do	2,667	4,789	2,667	1.80	55.70
	do	482	923	482	1.92	52.18
	77½ cents per dozen	6,715	10,372	5,205	1.54	50.18
	do	10,182	19,814	7,891	1.95	39.83
	do	10,678	21,002	8,275	1.97	39.40
	do	10,228	22,025	7,927	2.15	35.99
	do	3,827	7,754	2,966	2.03	38.25

aly 1 to Aug. 5, 1909, under act of 1897.
ug. 6, 1909, to June 30, 1910, under act of 1909.
aly 1 to Oct. 3, 1913, under act of 1909.

Files—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual consumption value
		Dozens.				*Per cent.*
1914[1]	25 per cent	105,172	$85,651	$21,413	$0.814	[illegible]

[1] Oct. 4, 1913, to June 30, 1914, under act of 1913.

Files, file blanks, rasps, and floats, total—Imports for consumption—Revenue.

Fiscal year.	Rate of duty.	Quantity.	Value.	Duty collected.	Value per unit of quantity.	Actual consumption value
		Dozens.				*Per cent.*
1907	30 cents to $1 per dozen.	105,769	$86,653	$64,725	$0.812	
1908	....do	81,678	65,476	49,225	.802	
1909	....do	37,942	27,803	22,061	.733	
1910	25 cents to $1 per dozen.	80,313	64,206	43,699	.799	
1911	25 to 77½ cents per dozen.	73,802	66,298	40,550	.898	
1912	....do	68,163	62,094	37,548	.911	
1913	....do	60,453	55,076	32,692	.911	
1914	25 to 77½ cents per dozen or 25 per cent.	121,787	101,949	30,557	.837	
1915	25 per cent	46,684	38,590	9,648	.823	
1916	....do	64,591	43,021	10,755	.666	
1917	....do	72,884	61,132	15,283	.839	
1918	....do	54,616	59,903	14,976	1.097	
1919	....do	26,086	37,325	9,331	1.431	
1920[1]	....do	83,197	100,471	25,118	1.231	

[1] Calendar year.

Files and rasps [1]—Domestic exports (fiscal years).

Exported to[2]—	1918	1918 [3]	1
France	$148,893	$89,779	
Italy	975,454	800,867	
Russia in Europe	186,490		
Norway		52,680	
Spain	63,587	44,683	
England	235,933	169,659	
Canada	181,027	155,256	
Mexico	65,191	86,011	
Cuba	84,223	79,329	
Argentina	91,446	107,795	
Brazil	164,335	96,535	
Chile	77,713	81,795	
China	44,039	41,723	
British India	385,713	333,732	
Straits Settlements	42,071	70,955	
Japan	51,216	84,254	
Australia	374,858	399,889	
New Zealand	46,819	55,211	
Philippine Islands	77,386	104,295	
British South Africa	76,495	53,977	
All other	308,536	377,000	1
Total	3,681,457	3,265,385	5

[1] Included in "all other tools" prior to 1918.
[2] All countries to which exports exceeded $25,000 in 1918 (fiscal year).
[3] Calendar years.

Files, 8-inch mill, bastard, Nicholson—Prices per dozen, wholesale, Providence, R. I.

[From War Industries Board Price Bulletin No. 33: Prices of Iron, Steel, and Their Products.]

	1913	1914	1915	1916	1917	1918
Year	$0.9203	$0.9160	$0.9144	$1.0496	$1.3723	$1.6371
Quarter:						
First	.9230	.9180	.9140	.9150	1.2330	1.4790
Second	.9217	.9167	.9140	1.0450	1.2983	1.6430
Third	.9187	.9153	.9147	1.0450	1.4790	1.6430
Fourth	.9180	.9140	.9150	1.1933	1.4790	1.7833
Month:						
January	.9230	.9180	.9140	.9150	1.2330	1.4790
February	.9230	.9180	.9140	.9150	1.2330	1.4790
March	.9230	.9180	.9140	.9150	1.2330	1.4790
April	.9220	.9180	.9140	1.0450	1.2330	1.6430
May	.9220	.9160	.9140	1.0450	1.3310	1.6430
June	.9210	.9160	.9140	1.0450	1.3310	1.6430
July	.9200	.9160	.9140	1.0450	1.4790	1.6430
August	.9180	.9160	.9150	1.0450	1.4790	1.6430
September	.9180	.9140	.9150	1.0450	1.4790	1.6430
October	.9180	.9140	.9150	1.1610	1.4790	1.7640
November	.9180	.9140	.9150	1.1610	1.4790	1.7930
December	.9180	.9140	.9150	1.2580	1.4790	1.7930

Rasps, horse, 16-inch, plain—Prices per dozen, wholesale.

[From War Industries Board Price Bulletin No. 33: Prices of Iron, Steel, and Their Products.]

	1913	1914	1915	1916	1917	1918
Year	$4.0681	$4.0681	$4.0681	$4.0681	$4.6360	$5.1672
Quarter:						
First	4.0681	4.0681	4.0681	4.0681	4.6360	4.6360
Second	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
Third	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
Fourth	4.0681	4.0681	4.0681	4.0681	4.6360	5.6018
Month:						
January	4.0681	4.0681	4.0681	4.0681	4.6360	4.6360
February	4.0681	4.0681	4.0681	4.0681	4.6360	4.6360
March	4.0681	4.0681	4.0681	4.0681	4.6360	4.6360
April	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
May	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
June	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
July	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
August	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
September	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
October	4.0681	4.0681	4.0681	4.0681	4.6360	5.2155
November	4.0681	4.0681	4.0681	4.0681	4.6360	5.7950
December	4.0681	4.0681	4.0681	4.0681	4.6360	5.7950

Court and Treasury Decisions.

In measuring the length of files, the distance from the heel (the part where the tang begins) to the point (the opposite end) of the file should be included; the tang is the only portion of the file to be excluded. (G. A. 5410, T. D. 24638, of 1903.) Riffle files are dutiable according to their full length and not their cutting surface only. (G. A. 5672, T. D. 25268, of 1904.) Nail files are not within this provision (G. A. 7787, T. D. 35793, of 1915), nor are fraises—the abrading parts of machines which sharpen knives of beet-cutting machines—"files" within this provision (United States *v.* American Express Co., 6 Ct. Cust. Appls. 494, of 1916).

Manicure instruments consisting of a steel blade having no cutting edge, one side of which was a file, the other highly polished, and provided with a silver handle were held not to come within the provision for files, but to be dutiable as manufactures of metal. (Stern *v.*

United States, 72 Fed. 52.) But flat, thin pieces of steel from 4 to 7 inches in length and in width tapering from one-half inch or more to almost a point, with more than one-half inch the length on both sides of the steel in the form of a file, while the other part of the handle was smooth, were held to be files within paragraph 141 of the act of 1894. (G. A. 3763, T. D. 17829.)

Files—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, specific and ad valorem.
1883	176	Files, file blanks, rasps, and floats, of all cuts and kinds:	
		4 inches in length and under	35 cents per dozen.
		Over 4 inches in length and under 9 inches	75 cents per dozen.
		9 inches in length and under 14 inches	$1.50 per dozen.
		14 inches in length and over	$2.50 per dozen.
1890	168	Files, file blanks, rasps, and floats, of all cuts and kinds:	
		4 inches in length and under	35 cents per dozen.
		Over 4 inches in length and under 9 inches	75 cents per dozen.
		9 inches in length and under 14 inches	$1.30 per dozen.
		14 inches in length and over	$2 per dozen.
1894	141	Files, file blanks, rasps, and floats, of all cuts and kinds:	
		4 inches in length and under	35 cents per dozen.
		Over 4 inches in length and under 9 inches	60 cents per dozen.
		9 inches in length or over	$1 per dozen.
1897	156	Files, file blanks, rasps, and floats, of all cuts and kinds:	
		2½ inches in length and under	30 cents per dozen.
		2½ inches in length and not over 4½ inches	50 cents per dozen.
		Over 4½ inches in length and under 7 inches	75 cents per dozen.
		7 inches in length and over	$1 per dozen.
1909	155	Files, file blanks, rasps, and floats, of all cuts and kinds:	
		2½ inches in length and under	25 cents per dozen.
		Over 2½ inches in length and not over 4½ inches	47½ cents per dozen.
		Over 4½ inches in length and under 7 inches	62½ cents per dozen.
		7 inches in length and over	77½ cents per dozen.
1913	131	Files, file blanks, rasps, and floats, of all cuts and kinds	25 per cent ad valorem.

AXES.

SUMMARY.

Axes and hatchets to the value of $5,142,503 were produced in the United States in 1914. Half of the 20 ax-manufacturing establishments listed in the roster of the Hardware Manufacturers' Organization for War Service, 1918, are in Pennsylvania; the rest are in Massachusetts, New York, New Jersey, West Virginia, and Vermont.

No imports of axes are specified in Commerce and Navigation. Exports have been large—at least since 1913. In 1914 the value of axes exported was $1,115,303, equal to 21.7 per cent of the value of axes and hatchets produced in the United States in that year. In 1918 exports were valued at $1,019,792, and in 1920 at $1,346,032. American axes dominate the market in the United States, compete successfully with foreign-made axes in other North American countries, in South America, Asia, and Oceania, but have made little headway in European markets. Of the total exports in 1918 only about 3 per cent went to Europe.

Axes were not specially provided for by the tariff act of 1883, nor by any subsequent tariff act. They have therefore been dutiable as manufactures of metal not specially provided for. As such they were dutiable at 45 per cent ad valorem under the acts of 1897 and 1909 and are now dutiable at 20 per cent under the act of 1913, paragraph 167.

Axes.—Summary table.

Year.	Domestic production.[1]	Value of domestic exports.[2]	Domestic exports.[2]	Ratio of exports to production.
			Number.	
1913			[3] 1,344,402	
1914	[4] $5,142,503	[4] $1,115,303	1,911,071	21.7
1915		592,217	745,865	
1916		712,911	1,180,654	
1917		858,652	1,310,550	
1918		1,019,792	1,353,045	
1919		1,366,537	1,796,537	
1920		1,346,032	1,346,032	

[1] Census year.
[2] Fiscal years ending June 30. Figures are for axes only.
[3] Not specified prior to 1913.
[4] Axes and hatchets.
[5] Percentage value of axes exported from total of value of axes and hatchets produced.

GENERAL INFORMATION.

TARIFF PARAGRAPH, ACT OF 1913.

PAR. 167. Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of iron, steel, * * * or any other metal, but not plated with gold or silver, and whether partly or wholly manufactured, 20 per cent ad valorem.

DESCRIPTION.

The forms and weights of axes vary according to the use to which the tool is to be put and to suit the preferences of the users. Common forest axes weigh from 3 to 7 pounds each. In Shapleigh's General Hardware Catalogue the weights shown are from 3 to 5½ pounds. In that catalogue are shown also the outlines of the various patterns of axes, 42 in number. The names of some of these patterns indicate the shape or use, as turpentine, wedge, falling, peeling, etc.; the names of others doubtless indicate patterns fashioned to meet the needs of particular regional forest conditions, as Michigan, Maine, Kentucky, Puget Sound falling, etc. Axes may be single bit; i. e., with one cutting edge, or double bit, with two cutting edges. Along with axes proper might be grouped broadaxes, a special type of ax, with a cutting edge of 10 to 12 inches, used for hewing and shaping large timbers by carpenters, tie makers, etc. Another special type of ax is the adze, with the handle so inserted as to be at right angles with the cutting edge. Along with this group of cutting tools might be considered also hatchets of all kinds, as shingling hatchets, claw hatchets, broad or bench hatchets, lathing hatchets, etc.

DOMESTIC PRODUCTION.

Materials and methods of production.—The American ax is usually made as follows:

A head or butt of wrought iron is heated to a white heat, cut to the desired length, and then, after the eye for the handle is punched through, reheated and pressed between concave dies into proper shape. Again heated, it is grooved on the edge, and with borax as a flux, an arched edge piece of steel is inserted, projecting an inch or more. The iron and steel are then welded at white heat. The ax is then hammered, ground to a fine edge, tempered, and polished. Finally the head may be varnished to prevent rust.

Few data are at hand relating to the proportion labor costs bear to total costs in the production of axes. One manufacturer stated in a letter to the Tariff Commission that shop labor costs amount to 20 per cent of the selling price of axes, as against 39 per cent for raw material, factory supplies, light, and fuel.

Organization.—The Census of Manufactures of 1914 reports 25 establishments, with a capital of $8,340,000, engaged primarily in the production of axes and hatchets. The number of wage earners employed in 1914 was 2,822; wages paid amounted to $1,574,000, and the value of the product was $4,806,000. In addition, axes and hatchets to the value of $336,503 were produced in 1914 by establishments engaged primarily in other industries, principally "carpenter's tools, not elsewhere specified," and "agricultural implements." The total value of the product reported in 1914 was therefore $5,142,503. The census gives no details as to the size of the establishments. The average number of wage earners employed per establishment in 1914 was 113.

Geographical distribution.—The Roster of the Hardware Manufacturers' Organization for War Service (1918) lists 20 firms manufacturing axes. Ten of these are in Pennsylvania, 4 in Massachusetts, 2 each in New Jersey and New York, and 1 each in West Virginia and Vermont.

Domestic production and consumption.—In 1914 exports of axes were valued at $1,115,303, as compared with $5,142,503, the value of

axes and hatchets produced in that year, or 21.7 per cent. No imports are specified in Commerce and Navigation. Domestic production is doubtless in excess of domestic consumption.

Domestic exports.—In 1913, 1,934,492 axes, valued at $1,177,353, were exported. Of these, 500,595, valued at $311,981, went to Brazil; 284,476, valued at $191,382, to Australia; 204,308, valued at $122,810, to Argentina; and 125,338, valued at $75,062, to Mexico. In 1914 exports decreased slightly, and in 1915 they fell to 795,865 axes, valued at $502,217.

In 1916, 1917, and 1918 exports increased in quantity and value, amounting in 1918 to 1,315,045 axes, valued at $1,019,792. In quantity this was 68 per cent, and in value 87 per cent of the 1913 exports. Unless, therefore, the 1913 exports were abnormally large, exports of axes during the war period were below normal. Exports increased some in 1919 but declined again in 1920, amounting in the latter year to 1,346,032 axes valued at $1,346,032.

Of the 1,315,045 axes exported in 1918, 357,904 went to Brazil; 159,721 to Argentina; 109,590 to Cuba; and 98,269 to Australia. It will be seen from the foregoing that exports have gone mainly to countries outside of Europe. In the list of 12 leading countries shown on the export table, infra, England is the only European country that appears. The list includes four South American countries, Canada, Mexico, and Cuba, Australia, New Zealand, the Straits Settlements, and British South Africa. American axes have, therefore, been exported mainly to countries in which the manufacturing industries have not been highly developed.

FOREIGN PRODUCTION.

Production statistics for foreign countries are not available. Germany is shown, however, to be a large producer of axes, hatchets, etc., by her import and export statistics. Imports of axes, hatchets, etc., in 1912 were valued at $154,600, and in 1913 at $161,800, while exports in 1912 were valued at $1,880,600, and in 1913 at $2,367,600. Germany's exports of axes, hatchets, etc., in excess of imports of these articles in 1913, were therefore greater than exports of axes from the United States in that year. It is possible, however, that a large part of these German exports consisted of hatchets and other articles. Consumption of axes in Germany also is much smaller than in the United States, her forest resources not being comparable in extent to our own.

A large variety of axes are turned out in Sweden. The principal Swedish axe manufacturers are Hults Bruk, at Aby, and B. & O. Liberg, at Eskilstuna. The material of Swedish axes is uniformly of A–1 quality native steel.

Axes are also manufactured in England, France, Russia, and other European countries, but no data are available to indicate the relative importance of the various countries as producers.

IMPORTS.

No import statistics are available, imports of axes not being specified in our Commerce and Navigation reports. It is probable that imports are very small. One ax manufacturing firm stated in a letter to the Tariff Commission in January, 1920, that they had been producing axes for about 40 years and had not met any foreign competition in the domestic market.

PRICES.

The average wholesale price per dozen of single-bit, first-quality axes (base weight) at New York was $7.27 in 1913, and $7.50 in 1914. In April, 1915, the price dropped abruptly to $4.25 per dozen. In 1916, several price increases occurred, and by December of that year the price stood at $11.75. The price remained high during 1917 and 1918, ranging from $10 to $14 per dozen. The average yearly, quarterly, and monthly prices for single-bit, first-quality axes for the years 1913–1918 are shown infra. The Hardware Age quotes the price of these axes at $14 per dozen on January 16, 1919, at $15 on July 3, 1919, and at $13.50 on December 24, 1919. Prices during 1918 and 1919 were about double the average price in 1913, and about three times the price prevailing during the last nine months of 1915.

TARIFF HISTORY.

Axes were not specially provided for in the act of 1883, nor in any subsequent tariff act. They have therefore been dutiable under the various acts as manufactures of iron or steel not specially provided for. As such, axes were dutiable at 35 per cent ad valorem under the act of 1894, at 45 per cent under the acts of 1897 and 1909, and are now dutiable at 20 per cent under the act of 1913, paragraph 167.

COMPETITIVE CONDITIONS.

Because of our large timber resources and our heavy consumption of wood, the United States is doubtless the greatest consumer of axes in the world. Aside from any tariff factor, American manufacturers are in an advantageous position to supply the large domestic demand, since they are more familiar with the particular patterns of axes required by consumers in various parts of the country than foreign producers. Furthermore, it appears from the data at hand that in the manufacture of axes, labor costs do not represent as great a proportion of total costs as raw material, factory supplies, power, fuel, and light, and that consequently advantages European producers may enjoy with respect to lower wages are of less importance in this industry than in the manufacture of files, nippers, and pliers, or other tools in which labor costs represent a greater proportion of total costs. For these reasons domestic production has grown large, and American manufacturers meet with little foreign competition in the domestic market. Since 1913, and doubtless since an earlier date, exports have been heavy and American axes have successfully met European competition in South America, Australia, Canada, and other countries, although few have been sold in European markets. In view of the advantageous location of American manufacturers, the well-developed condition of the industry, the abundant supply of raw material—iron and steel—and fuel, and the heavy sales in foreign markets in competition with European producers, and the absence of serious competition in the domestic market in the past, it would seem that domestic producers have little reason to fear a foreign invasion of their home market in the near future.

TARIFF CONSIDERATIONS.

Axe manufacturers questioned by the Tariff Commission have shown little interest in the tariff and are apparently not much concerned about foreign competition.

Axes and hatchets—Production in United States.

[From Federal census.]

	Value.
.....	[1] $5,142,503

Axes—Domestic exports.

FISCAL YEARS.

rted to—	1913		1914		1915	
	Number.		*Number.*		*Number.*	
.....	6,713	$4,252	10,061	$6,569	9,691	$5,732
.....	83,122	44,526	70,548	38,493	20,183	11,288
.....	125,338	75,062	47,156	28,023	24,680	15,598
.....	61,179	44,852	64,527	46,739	62,626	44,510
.....	204,308	122,810	139,307	86,870	13,454	7,776
.....	500,595	311,961	293,876	172,856	60,496	44,223
.....	40,177	27,707	38,820	27,544	14,950	10,765
.....	55,961	35,673	33,060	22,877	24,895	17,558
ients.....	46,140	19,726	80,321	25,660	23,048	10,853
.....	284,476	191,382	507,691	319,297	218,458	148,989
.....	58,474	38,137	81,052	56,507	63,041	42,918
Africa.....	46,250	24,087	74,238	35,616	31,249	17,556
.....	421,769	237,158	473,417	248,252	229,104	124,451
.....	1,934,492	1,177,353	1,914,074	1,115,303	795,965	502,217

rted to—	1916		1917		1918	
	Number.		*Number.*		*Number.*	
.....	114,640	$67,932	18,455	$11,630	17,638	$11,429
.....	13,048	6,724	17,681	12,280	10,303	9,706
.....	22,232	15,243	55,482	41,036	53,358	46,139
.....	96,907	70,589	105,112	82,706	109,590	98,380
.....	90,450	53,852	120,475	74,293	159,721	119,271
.....	167,396	99,205	278,920	184,149	357,904	285,018
.....	33,948	21,471	34,054	22,963	23,569	19,491
ients.....	29,206	19,123	24,990	15,993	20,655	16,785
.....	29,972	14,675	72,233	29,856	95,117	56,854
.....	240,854	150,424	202,989	143,280	98,269	74,940
.....	41,866	26,821	54,254	37,146	19,183	15,466
Africa.....	44,559	23,012	28,278	17,499	33,146	24,902
.....	254,581	150,948	297,647	180,821	316,592	241,411
.....	1,180,659	712,019	1,310,570	853,652	1,315,045	1,019,792

CALENDAR YEARS.

Exported to—	1918		1919	
	Number.		*Number.*	
.....	360	$325	5,864	$5,015
.....	9,204	7,026	55,608	56,090
.....	5,332	6,131	23,902	27,441
.....	52,288	55,230	109,127	119,645
;public.....	91,406	90,998	95,650	107,714
.....	32,310	27,377	16,608	15,471
.....	138,147	119,341	131,241	127,519
.....	327,143	284,446	345,960	359,943
.....	24,826	23,390	35,267	35,937
.....	18,427	17,522	16,564	17,677
.....	12,316	12,244	13,420	13,720
.....	15,814	14,115	27,616	29,382
Settlements.....	89,103	66,173	94,292	68,133
dies.....	19,629	18,268	46,303	42,642
.....	92,732	84,777	196,818	225,337
.....	17,418	14,278	42,775	50,542
.....	37,888	31,907	57,069	62,542
.....	33,702	29,218	74,621	84,187
.....	111,171	104,052	159,823	164,925
.....	1,129,216	1,096,848	1,549,128	1,613,862

[1] 36,503 produced in establishments not primarily engaged in the production of axes and

Axes, single bit, base weight, first quality—Prices per dozen, wholesale, New Yo

[From War Industries Board Price Bulletin No. 33: Prices of Iron, Steel, and Their Product

	1913	1914	1915	1916	1917	1
Year	$7.2708	$7.5000	$5.0625	$8.0104	$10.9333	1
Quarter:						
First	7.1667	7.5000	7.5000	4.9583	10.0000	
Second	7.2500	7.5000	4.2500	7.5417	10.0000	
Third	7.2500	7.5000	4.2500	9.2917	11.3333	
Fourth	7.4167	7.5000	4.2500	10.2500	12.0000	
Month:						
January	7.1250	7.5000	7.5000	4.6250	10.0000	
February	7.1250	7.5000	7.5000	5.1250	10.0000	
March	7.2500	7.5000	7.5000	5.1250	10.0000	
April	7.2500	7.5000	4.2500	5.1250	10.0000	
May	7.2500	7.5000	4.2500	8.6250	10.0000	
June	7.2500	7.5000	[1] 4.2500	8.8750	10.0000	
July	7.2500	7.5000	[1] 4.2500	8.8750	11.0000	
August	7.2500	7.5000	[1] 4.2500	9.5000	11.0000	
September	7.2500	7.5000	[1] 4.2500	9.5000	12.0000	
October	7.2500	7.5000	4.2500	9.5000	12.0000	
November	7.5000	7.5000	4.2500	9.5000	12.0000	
December	7.5000	7.5000	4.2500	11.7500	12.0000	

[1] No prices quoted; interpolated by War Industries Board.

Axes—Rates of duty.

Act of—	Par.	Tariff classification or description.	Rates of duty, and ad valo
1883	216	Manufactures, articles, or wares, not specially enumerated or provided for in this act, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	45 per cent ad
1890	215	....do....	Do.
1894	177	Manufactured articles or wares, not specially provided for in this act, composed wholly or in part of any metal, and whether partly or wholly manufactured.	35 per cent ad
1897	193	Articles or wares not specially provided for in this act, composed wholly or in part of iron, steel, * * * and whether partly or wholly manufactured.	45 per cent ad
1909	199	....do....	Do.
1913	167	Articles or wares not specially provided for in this section; * * * if composed wholly or in chief value of iron, steel, * * * and whether partly or wholly manufactured.	20 per cent ad

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UNITED STATES TARIFF COMMISSION
WASHINGTON

TARIFF INFORMATION SURVEYS

ON THE ARTICLES IN

PARAGRAPHS 128, 129, 130, AND 131 OF THE TARIFF ACT OF 1913

AND RELATED ARTICLES IN OTHER PARAGRAPHS

CUTLERY, FILES, AND AXES

Paragraph 128:
Penknives, Pocket Knives, etc.
Razors.

Paragraph 129:
Swords and Sidearms.

Paragraph 130:
Table and Other Cutlery.

Paragraph 131:
Files, Rasps, and Floats.

Paragraph 167:
Axes.

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WASHINGTON
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1921

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